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EDITOR & PUBLISHER: WALTER KING. OFFICE: 11, BOLT COURT, FLEET ST., LONDON.

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EDITORIAL NOTES—GAS, &c.

Vertical Retorts.

A MEETING without papers and yet full of technical interest was held by the Manchester Institution of Gas Engineers and Managers on Saturday. The scene of the meeting was Liverpool, the hosts for the day were the Chairman and Directors of the Liverpool United Gaslight Company, who were represented by their Chief Engineer (Mr. Edward Allen), and their works provided the technical interest. One, indeed, would have to go far from Liverpool at the present time to find in any single Company's manufacturing operations so much that is of current importance incorporated as is here. The Company cannot be charged with not having done a big part and a good part in making up the road for progress in gas manufacture. They have investigated and given trial to new systems; and that which has proved itself to be something better for their purposes than has been their previous practice has been adopted—as in the case of the Fiddes-Aldridge retort discharger-charger. The Company are still investigating—now, particularly, vertical retorts on the continuous system of Messrs. Woodall and Duckham, and an adaptation of a carburetted water-gas set to the methane-hydrogen system. If results justify, these, too, may receive extended adoption. The fruits of such research by a Company positioned in the matter of resources as are the Liverpool Company are invaluable to the whole of the gas industry.

But it is of vertical retorts that we particularly want to speak here—the inspection on Saturday of the two sets of four Woodall-Duckham retorts at the Linacre works at Liverpool, and the article (p. 695) on an investigation of the Dessau system by engineers of the Union des Gaz, suggesting reference to certain fresh points. Alluding to the article first, it will be seen that for an installation of eighty vertical retorts at Genoa the Dessau settings have been favoured; and labour considerations rather than any really superior results in output over horizontal or inclined retort working have supplied a persuasive element in decision. But technically the important feature of the article in question is supplied by the differences in working results that the investigators for the Union des Gaz found between the 4-metre and the 5-metre retort; the balance of favourable result being, according to these investigators, on the side of the 4-metre retort. If there has been no mistake about this, the natural question arises, Why should anyone build 5-metre retorts on the Dessau system if results as good—they are reported to be even better—can be realized from 4-metre lengths? The longer retort must necessitate a greater expenditure of capital, more outlay possibly in wear and tear, and more possibly in fuel for heating. There must surely be some explanation of these differences adverse to the 5-metre retort, as, knowing what we do of Herr E. Körting, it is inconceivable that he is following a mere idle fancy in the matter of the adoption of an additional metre, which is to all intents and purposes accused of adding to the cost without supplementing profitable effect.

Turning to the information obtained during the inspection of the Woodall-Duckham settings at Liverpool, it includes several points of interest. It must be remembered that, in this system, something more is aimed at than the carbonization of coal in vertical retorts, with the attendant advantages of so doing. Continuous charging and continuous discharging are integral parts of the system. The charging arrangements were conceived and developed on simple and effective lines—so simple, in fact, that we can easily imagine for them a life of many years, such as has been experienced with certain simple mechanical devices used in conjunction with vertical retorts in the shale oil-works. But the arrangements for removing the coke from the bottom of the retort—involving a conveyor and a water seal—have always not only appeared but have been a salient weakness acknowledged as much by the inventors as attacked by callous critics of the plant. Since the erection of the Liverpool plant, this means of extraction have been entirely superseded by a patented arrangement composed of an inclined bottom hopper, a pronged roll, and a drum hopper—a combination as simple as the charging mechanism—as described in our notes on the visit to the Liverpool works on Saturday. But let us emphasize this—that in altering the coke-extracting arrangement, the inventors have not in any way altered the principle of the system. All they have changed has been the method of extracting the coke after its discharge from the retort. The reports of the working of a setting on this system at the Poole works of the Bournemouth Gas and Water Company are good. As to the results of the working of the system generally, What is there to be said against a fuel account of 15 lbs. per 100 lbs. of coal carbonized (the Poole working opens up the prospect of this going lower still), a production of 12,600 cubic feet of gas per ton of coal of 16·47-candle power, excellent calorific value, and a good, dry, hard, bright coke? So far as the production and illuminating power are concerned, the figures are from the Bournemouth return for one day last week; and, whatever the character of the coal, they are good. Such figures as these, and those realized at Nine Elms (*ante* p. 477), cannot go unheeded by anyone considering the relative claims of carbonizing systems.

However, the improvement and simplification effected in the Woodall-Duckham coke-extracting arrangement brings the system so much nearer—we hope quite to—the practical and commerical stage; and we now venture to expect its open entry into competition with other systems. Meantime, it is stated that those interested in the Dessau system are trying to obtain a footing for it in this country, by offering it to builders of retort-settings here to erect on certain royalty terms. It is time something was done with the system in this country if anything is going to be done at all; for the Patents and Designs Act of 1907 will come into operation on Jan. 1 next, with its revocatory penalties for not manufacturing or working patented articles or processes in this country. But it may here be noted that, in the opinion of Messrs. James Roberts and H. Fletcher Moulton, the joint authors of a book on the new Act, "although the fact that a "patentee has offered to grant licences will not be an answer "to a charge of non-working, it may substantially assist, or "its absence may substantially prejudice, the patentee in "showing that the process is worked to an adequate extent "in the United Kingdom or in proving satisfactory reasons "why it is not so worked." Those who are working the Dessau system may be depended upon to do their utmost to protect their interests.

The Gas Programme for Next Session.

THE programme of gas legislation for next session is now before us; and from whatever point of view it is examined, nothing can be discovered that raises expectation of the session presenting less cheerless features than its immediate predecessors. In all the more recent sessions, only one or two of the Gas Bills have been of a character to excite general interest; and looking at the notices of the promotions, the same may be predicted of the coming session. Mostly the Bills will be of small and, in project, commonplace order; and if the notices fairly adumbrate what is to succeed, it is quite possible not more than (if as many as) half-a-dozen will be contested before Committees. All told, there are only twenty notices of Bills dealing in whole or in part with gas supply, and seven of these are to be introduced by local authorities. There are also half-a-dozen Gas Provisional Orders. This is anything but a brave showing; but it has precedent in the past session.

Indubitably, the measure which will invite the greatest hostility is that which will bear the title of the East Metropolitan Power-Gas Supply. This is the promotion of the

British Coalite Company, upon which editorial comment was made last week. The Draycott Gas Company's Bill—in which they propose to end the warfare between themselves and the Long Eaton Gas Company in territory over which both have powers of supply—will also doubtless attract widespread attention. The position is a peculiar one; and, if there is not prior agreement, should result in an interesting discussion before a Select Committee of one or both Houses, and a not less interesting decision. In regard to the more general Bills promoted by Companies, most of them are merely for additional and ordinary modern powers. There are three limited Companies—the Bognor, Southwell, and Swinton and Mexbrough—proposing dissolution and reincorporation, and two new Companies—the Swansea Valley and the Greystones, Co. Wicklow—asking for incorporation with parliamentary powers. The Swansea Valley Company propose to acquire two or three small existing undertakings. Consolidation and conversion of capital, construction of new works, and extension of limits of supply are mentioned in several of the notices of Company measures. In conjunction with the latter subject, there are some proposals of purchase. For instance, we find the Derby Gas Company are contemplating the purchase of the Belper Gas-Works and a private gas-works at Milford; the Bromley (Kent) and Crays Companies have mutually planned the annexation of the works and powers of the latter by the former; and the Draycott Company not only desire (as mentioned above) to put an end once and for all to their differences with the Long Eaton Gas Company, but they request to be empowered to acquire the Castle Donington gas undertaking. Fresh prescriptions regarding the illuminating power of gas, with the modern testing powers, are sought by some half-dozen Companies. Among them, the notice of the Rhymney and Aber Valleys Bill assures us that the Company are going to ask that the Act shall provide that in future the candle power of the gas "shall not exceed 12 candles." The literal interpretation of this is that the Company desire to make it illegal for them to supply gas above 12 candles, but presumably lawful to supply gas of any power they like below. A special feature in the Llanelly Company's Bill is that they are intending to repeal section 38 of their Act of 1874, which confers upon the local authority the right to appoint an additional Director. Two Gas Companies—the Draycott and Southwell—are preferring a request for authority to apply for Electric Lighting Provisional Orders.

About the powers to be sought by local authorities (mostly in "Omnibus" Bills), there is nothing of any special character. Such matters as the extension of the limits of supply, new gas-works, and the quality and testing of gas are found here and there; but the most important proposals are those of the Tenterden and Wath-upon-Dearne authorities, who aspire to ownership of the local gas undertakings now in possession of limited Companies. In the case of Wath-upon-Dearne, purchase is to be by agreement, but the Tenterden Corporation have evidently not come to terms with the Company, seeing that the latter are applying for a Provisional Order. The Gas Provisional Orders are mostly introduced by small Companies, with the exception of the East Hull Gas Company, who are adopting this means of getting up-to-date in the matter of testing for illuminating power.

Two Municipal Departments, and Two Policies.

THE transfer of profits from municipal trading undertakings "in relief of the rates" has ever with us cut against the grain; and this has not been in any way diminished since municipalities have started electricity works which compete with the gas undertakings for business, but in most cases afterwards show an extreme reluctance to contribute to the rates, in proportion to the gas undertakings on the capital employed. The recent Gas Exhibition in Manchester appears to have much to answer for. It has certainly had a very bad effect on our electrical contemporaries; for they cannot banish it from their minds. Among other things, the "Electrical Review" is much incensed over a reference to what is, and what is not, done in Manchester by, respectively, the City gas and electricity undertakings; and it calls three columns of figures to witness that the electricity undertaking has not of late stood in need of financial help from the gas undertaking or from the rates. That is quite outside the point Alderman Gibson, the Chairman of the Gas Committee, has been protesting against on every available occasion—the last time at the dinner inaugurating the Manchester Gas Exhibition. The gravamen of his complaint is that the Gas Department are forced by the City Council to maintain the price of gas, in order that a contribution of £60,000 or more per annum may be paid to the City Fund; whereas the Electricity Department are under no such obligation, but merely contribute what, if any sum, they may think fit. At the same time, the latter are at liberty to enter into contracts with large consumers for the supply of electrical current for power and lighting at very low figures. That is one effect of their liberty in the matter of contribution to the rates; and our contemporary will hardly dare to seriously assert that this puts the two departments on an equality in the matter of competition.

The differential policy applied to the two undertakings is only one of the grounds for grievance; a second being that the considerable sum taken from the profits of the Gas Department is a direct cause of unequal taxation—money being drawn from the gas consumers, and used in relieving, among others, ratepayers who do not contribute anything to those profits. In Manchester, there are many large consumers of electricity, a number of whom do not consume any gas, but directly benefit by the compulsory delivery of gas profits annually into the City Fund. Why should they benefit by something they have not helped to produce? There has never yet been, nor will there ever be, a satisfactory answer to this question. A penny rate in Manchester represents £16,000; and thus £60,000 is equal to 3¾d. in the pound on the rates. If therefore a contribution to the rates of £60,000 from the gas profits does not represent a substantial assistance of the electricity consumers at the expense of the gas consumers, we do not know what it does represent. It is a monstrous condition of things that ought not to be allowed to exist in the administration of public affairs. All that the Gas Committee very properly ask is that their undertaking shall be put on a level footing with the Electricity Department in respect of the amount to be provided out of profits for the relief of the rates, and in respect of freedom in charges for their commodity.

Our electrical contemporary, as previously intimated, gives three columns of figures to show that the Electricity Department has not during the past three years required any subsidy whatever from the rates to help it along—there having been a net surplus of £4544 in 1905, of £16,206 in 1906, and of £26,267 in 1907. The subsidizing of the department is not the question at issue. But we should like to point out that the figures presented show that the net surplus is arrived at after meeting interest and sinking fund, making no provision for reserve, but putting to the renewal fund £38,328 in 1905, and £40,000 in both 1906 and 1907. This point as to renewals is of special interest in considering the general question of municipal trading; and it may enlighten our contemporary if a few comparative figures are quoted from the accounts of the two Manchester undertakings. In the first place, experience shows that the equated life of electrical plant is only about one-half that of gas plant. Bearing this in mind, the sum set aside for renewals in the Electricity Department appears to be altogether inadequate, It is the boast of the Gas Committee that they strictly proportion the amount set aside each year according to the known life of the different plant. Taking the figures for the year ending March 31 last, the Gas Department, on an employed capital of £2,680,449, provided for renewals £63,155, which is equal to 2·35 per cent. on the capital. On the other hand, the Electricity Department, with an employed capital of nearly as much—£2,385,495—only provided £40,000, or 1·67 per cent. on the capital; and this with the more rapidly depreciating plant! If the truth were told, it might be heard that the Electricity Committee could have done with the "net surplus" of £26,267 at the credit of the renewals fund, and more than that had it been found available. The net surplus and renewals account figures of the Gas Department for the past three years may also be quoted, in order that they may be contrasted with those given for the Electricity Department. The net surplus for 1905 was £66,068, for 1906 £40,591, and for 1907 £64,013; while the amounts placed to renewals account were respectively £49,000, £59,251, and £63,155.

Therefore, if figures and reasoning stand for anything, there was not, after all, very much substance to form a groundwork for the protest of the "Electrical Review." We will suggest to our contemporary, too, that perhaps the future will show that it would have been better policy on the part of the Electricity Committee, instead of squeezing out

a few thousands that they could call (if not in their innermost souls regard as) net profit, to have appropriated the whole of their balances for renewals. Rumour has it that the turbines now largely used by the department in their generating work are not as reliable as could be desired, and therefore are under the suspicion of eventually showing a shorter useful life than the old reciprocating engines. If this be true, then the financial sequel will be worth watching for. Meanwhile, the Gas Committee and their officials may be congratulated on the steady progress the gas undertaking is making year by year, despite the freedom allowed by an indulgent Council to the Electricity Department. We hope ere long wiser counsels will prevail in the City administration, and that a level line of policy will be pursued—instead of a preferential line for one—in the administration of the two competing trading undertakings. Let justice be done though the rates be raised and the price of gas lowered. Then, and not till then, will there be equality between the treatment of gas and electricity consumers.

The American Gas Institute and Gas Testing.

A WORD in season may have an important effect; and we hope that on this occasion such a word will have an effect that may merit the descriptive term. Our message is particularly addressed to the members of the American Gas Institute, who are now in a position to unite themselves with the Institution of Gas Engineers in trying to bring about the universal application of the system of testing the illuminating power of gas that has been adopted in this country by the Legislature and by all authorities who have a voice in framing gas-testing law and method. America has not as yet given its adhesion to any scientific unit of light; but the technical gas organizations are, in defence of their industry, bound to come to some common agreement on the subject of a unit and the instruments of light measurement, in the hope that what is done by them will prevent a repetition of the retrograde movement of the New York State Commission on Gas and Electricity Supply, who, in opposition to the recommendations of an Advisory Committee—consisting of Dr. A. C. Humphreys, Mr. A. E. Forstall, and Mr. R. M. Searle—appointed by the gas companies concerned, prescribed illuminating powers for gas and methods of testing that long experience in this country has proved are antiquated and inapplicable for common measurement of all grades of gas within the reasonable requirement of present-day purposes. In this country gas testing has in the past taken devious courses; but at length in the modern methods we have something—a combination of scientifically devised instruments whose use is directed on common-sense lines—which is generally acceptable as fair to all gas suppliers, whatever be their statutory standard of illuminating power up to 20 candles.

Acceptance likewise by the American Gas Institute of those instruments and methods would be of mutual advantage to them and to gas suppliers in this country, and would be materially helpful in forwarding what we believe, on practical grounds, would be beneficial, and that is a universal system of gas testing. In future, the American Gas Institute, by such adoption of the statutory system of gas testing now prevailing here, would find this latter fact of inestimable value in the prosecution of any testing project, or, if State authorities insist on imposing standard conditions and regulations as to illuminating quality, in convincing those authorities of the righteousness of applying, in preference to all others, the principles and instruments developed from a long and wide experience in this country. It may be advanced that the fact of a certain system prevailing in Great Britain did not have much weight with the New York State Commission; to which we should reply that it is our firm belief that the Commissioners will before long themselves become convinced that they committed an error in searching among the moraines of the past in gas testing for instruments and conditions to apply to the gas-supplying companies under their dominion. In this country, too, support would be gained from official adoption by the American Gas Institute of the instruments and methods constituting the modern gas-testing system here.

Singular as it may seem to outsiders—though we have in this system one that has developed from events in which the Legislature, the Board of Trade, the Metropolitan Gas Referees, the London County Council, and the Metropolitan Gas Companies have all of them been concerned to greater or less degree, and though the system has been endorsed by the Legislature and the Board of Trade and the other authorities named—it has not been applied to the British gas industry generally, but is only insisted upon when gas companies or gas-supplying authorities enter Parliament with proposals affecting the illuminating power of the gas they supply. The proposition is now before the Gas Companies' Protection Association that the initial steps should be taken to move the Legislature to make the application of the system general in Great Britain and Ireland within (we suppose) the range of the "Metropolitan" No. 2 burner—that is to say, up to gas of 20-candle power. All available support, from whatever quarter, is influential in the prosecution of such an appeal to Parliament. Further, the Institution of Gas Engineers authorized their delegates to the meeting of the International Photometric Committee at Zurich in the summer to advocate, in the interests of technical advance, a universal system of testing the illuminating power of gas, and that the standard instruments should be the "Metropolitan" No. 2 gas-burner and the Harcourt 10-candle pentane lamp. We submit that here again the union in this matter of the American Gas Institute and the Institution of Gas Engineers would carry considerable influence in furthering among the gas authorities of other countries the cause of, and the plea for, universality.

There does not appear to be any great obstacle to official adoption, by the American Gas Institute, of the modern system of testing gas for illuminating power as applied in this country, nor to their alliance with the Institution of Gas Engineers in advocating that the system should become universal. The American Institute at their recent meeting had a report before them by a Committee appointed to consider the "Methods of Taking Illuminating Power" (see *ante*, p. 486). The report was not so conclusive in its recommendations as we should have liked to see; and, in certain details, there might be adverse criticism. But in the main, on general points, it is clear the views of the Committee are in unison with the practice in this country. They make special reference, and anything but disapprovingly, to the No. 2 "Metropolitan" burner; and regarding the selection of a standard of light, they say they would choose the one which, while otherwise constant and reproducible, comes nearest to being affected by atmospheric changes exactly as the test flame is affected. In other words, they would expect it to be a flame of similar dimension, temperature, and air consumption as the test flame; and they consider that those conditions have nearest conformity in the 10-candle pentane lamp. They also recommend the bar form of photometer as being the most serviceable. Then, again, the New York Gas Companies' Committee (of whom, as mentioned already, Dr. Humphreys, the President of the Institute, was a member) recommended the State Commission to adopt the No. 2 "Metropolitan" burner and the Hefner-Alteneck amyl-acetate lamp or the Harcourt 10-candle pentane lamp as the standard light. So that, on all hands, the way seems clear to an official acceptance by the American Institute of the British system of testing; and thus would they assist in paving the way to a universality which would undoubtedly have an important bearing on the technical intercommunication of the gas industries of the different nations.

A Note of Warning.

The Bristol Corporation awoke one day last week to find themselves the object of quite an embarrassing amount of attention, which threatened to have consequences the very reverse of pleasant. The cause of the pother was the publication of a notice that the Corporation would apply to Parliament for leave to bring in a Bill to (*inter alia*) "repeal, alter, or amend all or some of the provisions of the Bristol Dock Acts, 1848 to 1907, or some or one of those Acts, with respect to the repayment of moneys borrowed, and to be borrowed, and the redemption of stock and the payment off of bills issued, and to be issued, under the power of those Acts or some or one of them (whether with or without the sanction or consent of any Government Department or other authority), and to make new provisions with respect to such repayment and redemption and payment off by extending the period or periods limited for repayment or redemption or payment off or by suspending for such period or periods, or such further period or periods, as the Bill may prescribe the obligations of the Corporation with respect to making provision for such repayment or redemption or payment off, or by both of such means or otherwise, and to make other new provisions with respect to moneys raised by borrowing

and the issue of stock and bills and the payment of interest on such moneys." When this became known, the jobbers on the London Stock Exchange expressed their opinion of the proposals by refusing to make a price in Bristol Corporation stocks, which were thereupon struck out of the Official List. No time was lost by the Town Clerk in wiring to the London papers to the effect that the proposals followed other precedents already allowed by Parliament, and consisted of the temporary suspension of contributions to sinking fund in respect of moneys borrowed for new dock works since 1901; the repayment of loans to be within the time allowed by Parliament. It was, he added, not proposed to alter the agreement with Corporation stock-holders, which would be strictly carried out. In a letter to the Bristol Stock Exchange, the Town Clerk said that the arrangements which the Corporation were about to make were "entirely of a domestic character;" and as a result of negotiations, it was officially announced at Bristol on Friday evening that an arrangement had been come to with the Stock Exchange Committee whereby the Corporation stock prices would re-appear in the Official List daily pending the publication of the terms of the proposed Bill. Until therefore the terms of the Bill are available, the matter must be allowed to rest; but meanwhile it is to be regretted that, if the agreement with the stock-holders "is to be strictly carried out," the notice was drafted in such a manner as to give rise to the suspicion that the rights of investors were to be in some way prejudiced. In any event, the incident may be borne in mind as showing that a watchful eye is being kept in financial circles on corporations and their loans; and on future occasions it is to be hoped that public bodies will see their way to make their intentions so clear at the very outset that no possibility of misunderstanding may arise—even through what the Town Clerk says in this case must have been "a misreading of the Parliamentary Notice, which, as is usual, was drawn in the widest terms." As the "Pall Mall Gazette" remarked when dealing with the matter, "we cannot have our corporation loans suspect."

PERSONAL.

The Directors of the York United Gaslight Company have appointed Mr. JOHN H. HILL as Secretary and Manager of the Company, in succession to Mr. Sidney H. Stevenson. Mr. Hill has been a long time with the Company, and for rather more than six years has held the position of Assistant Secretary and Manager. Mr. Hill is an associate member of the North of England Gas Managers' Association, and President for the year of the Yorkshire Junior Gas Association. We congratulate him heartily upon his promotion to a higher position in his Company's service. Referring to the appointment, the "Yorkshire Press" said: "Mr. Hill has been associated with the Company for many years, and has qualified himself in every way for the responsible and important position to which he has now been appointed as the reward of faithful and efficient service."

Mr. L. HISLOP, of Uddingston, a Past-President of the North British Association of Gas Managers, has been appointed by the Committee of that body to be Joint Secretary with Mr. R. S. Carlow, of Perth. It will be remembered that at the annual meeting of the Association in Glasgow last July Mr. Carlow tendered his resignation, on account of the state of his health, and that, regret having been expressed at the step he contemplated, he agreed to act till the next annual meeting; the Committee being granted power to make whatever temporary arrangements might be necessary, with the view of relieving Mr. Carlow of as much work as possible. Mr. Carlow's health has since become very much worse, and the Committee have felt it necessary to place in Mr. Hislop's hands the duties of the Secretaryship till the next annual meeting, to be held in Edinburgh in July.

Mr. ROBERT GRIMWOOD, the Chief Assistant in the Chemical and Gas Department of the London County Council, will retire, under the age-limit, on the 31st inst.; and in recognition of the valuable service rendered by him, more especially during the past seventeen years, the Council have, on the recommendation of the Establishment Committee, added ten years to the period in respect of which he is entitled to a retiring allowance under the Superannuation (Metropolis) Act, 1866. Consequent upon Mr. Grimwood's retirement, the Committee will, at the meeting of the Council to-day, recommend the promotion of Mr. J. H. COSTE, the Senior Assistant, to the vacant position, and of Mr. E. T. SHELBOURN to that now occupied by Mr. Coste. It is proposed to appoint subsequently a technical assistant in the department.

The death occurred recently, at the age of 75, of Mr. JOHN COPPEN, who was for many years a Director, and since about 1896 the Chairman, of the Staines and Egham Gas Company. He always took the keenest interest in the Company's affairs, and was a familiar figure in their district.

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 726.)

AFTER a long chapter of Jeremiads and lamentations, week after week, upon the state of things on the Stock Exchange, it is indeed a grateful task to have a brighter story to tell. A real turn for the better seems to have come at last; and, though it is always the unexpected that is most sure to happen, the change bids fair to stay. Last week opened with a good gleam of sunshine; a cheerful tone prevailed; and prices moved upwards, though the best of them failed to last till the end of the day. Tuesday was the same, though business was very quiet, and the adjustment of the account—a very light one—engrossed attention. The tone was still more encouraging on Wednesday, and good-quality stocks were in demand at rising prices; while most departments were firm in sympathy. Thursday was quite cheerful (the absence of all difficulty over the settlement being a good point), and investment business proceeded, although the inquiry became rather tamer before the close. Friday was a quiet day, but with a capital tone and rising prices uncrushed by realizations. Saturday was a nice finish to a bright week. The healthier look of things monetarily, and general relaxation from apprehension, imparted a cheerful tone. In the Money Market, there was the usual demand for Stock Exchange purposes and the end of the month; but rates did not stiffen. Discount showed an easier tendency in view of a clearer financial horizon. Business in the Gas Market was on a moderate scale, and was not to so great an extent restricted to one or two big issues as it had been in recent weeks—some of the less conspicuous stocks coming in for much notice. Prices on the whole were rather easier, but not uniformly so. In Gaslight and Coke issues, the ordinary was a good deal quieter but unimpaired in firmness—opening at 92⅜, and closing at 93⅝. In the secured issues, the maximum was done at 86¾ and 87¼; and the preference at 102 and 102¾. South Metropolitan was quiet and steady—changing hands at from 119 to 120. The debenture marked from 81 to 82¼. There was not much done in Commercials; the 4 per cent. being at 102 and 103; and the 3½ per cent. at 100. In the Suburban and Provincial group, Brentford new was done at 187, Bournemouth "B" at 16⅛, British at from 38½ free to 39½ (a fall of 1 in the quotation), Hastings 3½ per cent. at from 94 to 95, South Suburban at 114⅛, and West Ham at 100¼ and 101. Liverpools and Maidstone receded. In the Continental Companies, Imperial was half-a-point lower at from 169½ to 167½. Union marked 110, European fully-paid 22⅞, and ditto part-paid 17⅜ (a fall of ½). Tuscan marked 10¾ and 10⅝, and advanced ⅛. Among the undertakings of the remoter world, Buenos Ayres debenture changed hands at 92¼ (a fall of 1), Hong Kong at 19 and 19¼, Melbourne 5 per cent. at 100½, ditto 4½ per cent. at 101, Monte Video at 10⅜, Oriental at 140, River Plate at from 13⅛ to 13¼, and San Paulo at 13¾ and 13 5/16.

ELECTRIC LIGHTING MEMORANDA.

An Examination of Public Lighting Statistics—Unfair Methods in Comparison—Favouring Electricity—The "Candle Power per Annum" Absurdity—Practical Considerations all Favourable to Gas—Fires and Electricity Supply.

A SHORT time ago allusion was made in the "Memoranda" to a compilation, by Mr. Haydn Harrison, of public lighting statistics, in which he worked out, as is the custom of electricians who are afraid to take any other basis as a standard, a price for electricity "per candle power per annum" lower than for gas lighting. It is one of the humorous sides of this controversy between electric and gas lighting for street purposes that the electricians are reduced to having recourse to minutiæ before presenting this fictitious cheapness. In our previous comment on Mr. Harrison's figures, it was shown that he only accomplished his purpose by assuming illuminating powers that he knows full well have no real existence. At that time we had only a few of his figures at command; the remainder not being available through their seclusion in the volume of transactions of the Incorporated Municipal Electrical Association. Since then, however, the figures have been reprinted on a leaflet, and have received a wider circulation, obviously for the purpose of influencing local authorities—the figures, it is asserted, being for them "interesting" on the ground that "the total candle power of electric lighting is considerably in excess of gas lighting, while the average cost per candle power per annum is more than 50 per cent. less in the case of the electric light as against gas." Now that we have in possession the full figures, we accuse Mr. Harrison of having dealt most unfairly with them; and further we declare that, to say on the strength of the data that the cost per candle power per annum is more than 50 per cent. less in the case of electric light as against gas is absolutely untrue.

In the first place, the returns obtained refer to 175 towns in which electricity is partly used for public lighting, and 150 towns in which gas is partly used for the same purpose. Our first point is that the basis of comparison is wrong, and altogether unjust to gas lighting; for it follows that, in towns where there is electric lighting (and we see that of the 175 towns the electricity supply in 119 is a municipal undertaking), high-power gas-lamps in the main streets are almost, if not entirely, absent, and consequently gas, in such a comparison as candle power per annum, is

denied the advantage of such lamps. Then from the 175 towns with electric lighting, Mr. Harrison selects 150 towns to make comparison with the 150 gas-lighted towns; and here we further accuse him of having made his selection with affectionate consideration for the interests of electricity. In the 175 towns there are 48,150 electric arc and incandescent lamps, the total revenue from which is £363,083. In the 150 towns selected, there are 45,810 electric arc and incandescent lamps, the cost of which is £340,277. So that, taking the totals, there is a difference in the number of lamps of 2340, and in the cost of £22,806. The average cost of the 2340 lamps is therefore £9 10s. 7d.; while the average cost of the 45,810 lamps is only £7 8s. 6d. The point as to a favourable selection for electricity, we think, is proved by these figures; so that in the first two respects Mr. Harrison has been unfair to gas lighting.

Turning now to his comparative figures for the 150 towns, the first thing noticed is that in them there are 15,880 arc lamps and 29,930 electric incandescent lamps—together 45,810; while of gas-lamps there are 253,400. The cost of the 45,810 electric arc and incandescent lamps is £340,277, and of the 253,400 gas-lamps £684,180. That is to say, there are in the 150 towns five-and-a-half times more points of gas lighting than electric lighting, and yet the cost of the electric lighting reaches a sum half that of the total cost of the gas lighting. Put another way, while 45,810 points of electric lighting cost £340,277, 253,400 (or 207,590 more) points of gas lighting cost only £684,180. Is it to be wondered at, despite all the nonsense written about "candle power per annum" by electricians, that local authorities find that economy is on the side of gas? A more practical comparison than cost of "candle power per annum"—we challenge Mr. Harrison to produce the figures—will be to show the number of miles of roadway the gas-lamps and the electric lamps respectively cover, and then all lighting authorities will be in a position to ascertain the relative cost per mile of the two systems. At the present time the 150 towns, lumping electric arcs and electric incandescent lamps together, are paying an average of £7 8s. 6d. per point of lighting, against £2 14s. for gas.

Respecting the much-beloved "cost per candle power per annum," again we have to charge Mr. Harrison with unfairness to gas, and with a particularly fine display of benevolence towards electricity. For all practical purposes, this "cost per candle power per annum" is of no real value; for the fact remains that from all other basis of comparison—average cost per point of lighting, average cost per mile of street, and so on—incandescent gas lighting is superior. It is the most economical agent, and the best distributor of the illuminating power developed. However high in illuminating power the source of a light may be, if that illuminating power cannot be well diffused along the road surfaces so as to be of the greatest service and produce economy for those who pay, the division of the cost by the number of candles-power in that concentrated illumination is a fallacious proceeding, and of no value in considering the question of public lighting from the standpoints of economy and efficiency.

But supposing it had value, let us see how Mr. Haydn Harrison brings out his cost of 16·4d. per candle power for gas and 7·4d. for electricity. He supposes the gas-lamps give only 40-candle power; and he eases his conscience by saying that "this, allowing for the fact that a large percentage of flat-flame burners are still in use, is an ample allowance." While suggesting that there is a "large percentage" of flat-flame burners still in use, he does not allow that there are anything more than ordinary incandescent gas-burners in use—nothing in the way of double, triple, high-power, or high-pressure incandescent gas-burners. Therefore, in his wisdom, having to make out a case for electricity, he says 40-candle power per lamp will do for gas. If it is true there are a "large percentage" of flat-flames in use in the year 1907, it speaks of two things—gross neglect of the local authorities to modernize, or wilful refusal to modernize the gas-lamps out of consideration for electricity. An ordinary incandescent gas-lamp giving 60-candle power costs just about the same as a flat-flame gas-lamp, in view of the difference in consumption between 3½ or 4 cubic feet of gas per hour for the incandescent burner and 5 and 6 cubic feet per hour for the flat-flame burner over (say) 4000 lighting hours in the year, which difference is ample to pay for mantle renewal, any increase in attendance, and (spread over a period) the capital charges for conversion. There we see that, in a comparison intended to influence lighting authorities, Mr. Harrison is ungenerous to gas, and shows his comparison to be unworthy of consideration by fair-minded men. The lowest and the proper figure for him to have taken for gas would have been 60 candles, for that is the illuminating power that can be obtained at no greater expense than for flat-flame lighting. Let us see how he deals with electricity in contrast to his 40 candles for gas. He takes 600 candles as the average illuminating performance of arc lamps. Now electrical men who study Mr. Harrison's figures will smile when they regard this average of 600 candles, and look into their districts and see what the fluctuating arc lamps are really doing; and they will admit—perhaps not to lighting authorities, but among themselves—that 400 candles as an average would be a liberal concession to arc lamps. Then Mr. Harrison takes the average illuminating power of incandescent electric lamps at 50 candles. We may at once challenge Mr. Harrison to show that, in the streets of those 150 towns, there are no 16-candle and 32-candle power incandescent electric lamps; and that the 29,930 incandescent lamps are all 50-candle power Nernsts, tantalums, or other of the higher power types. If he had taken an average of 32-candle power, we should not have found any great fault with him.

Although, it may be repeated, we do not place any real value upon this "candle power per annum" calculation, let us see what the adoption of our revised figures would produce. Allowing 60-candle power for the 253,400 gas-lamps (for they ought all to be incandescent, seeing that the cost would be no more), we should have a total candle power of 15,204,000, instead of the 10,136,000 candles mentioned by Mr. Harrison. Taking the average illuminating power of the 15,880 arc lamps at 400 candles, and the 29,930 incandescent electric lamps at 32 candles, we have a total illuminating power for electricity of 7,309,760 candles. Dividing the £684,180 (the total cost of the 253,400 gas-lamps) by the 15,204,000-candle power, we arrive at a cost per candle power per annum of 10·1d. Dividing the £340,277 paid for the 45,810 electric lamps by the 7,309,760 candles, and we arrive at 11·1d. as the cost per candle power per annum. If anyone has aught to say against these figures—bearing in mind that cost per candle power per annum is regarded by us for all practical purposes as a ridiculous basis—and in defence of Mr. Haydn Harrison's calculations, let it be said.

While on this question of the cost of public lighting, we may just refer to the news columns of last week's "JOURNAL" for points bearing upon it. It is seen that at Newcastle-on-Tyne, a small extension of electric lighting in the streets is under consideration; and a correspondent of a local paper calls attention to the fact that the lighting of the North Road by gas used to cost £200 a year; by electricity, it now costs £700. The lighting of Jesmond Road by gas used to cost £150; it now costs by electricity £500. Osborne Road used to cost £130; now it costs £500. Gallowgate used to cost £73; now it costs £230. These figures strike home more than Mr. Harrison's "cost per candle power per annum." But cost is not the only matter to be considered in connection with public lighting. Refer again to last week's "JOURNAL;" and it will be remarked that at Brighton on the previous Thursday night the electricity supply failed—true for only a few minutes. But reliability is of great importance in public lighting—at least local authorities used to think so before they started electric lighting works. But fidelity to old principles undergoes change with change of condition. It was announced, too, that at the King's Theatre, Hammersmith, the light failed just recently. The owner and manager stated that the experience was not uncommon; and that for reliability gas is "second to none." In the previous week's issue, report was made of a failure of the electric current at York, which resulted in the throwing of the electrically lighted streets in darkness. Swansea, too, on a Thursday evening earlier in the month, suffered a breakdown on a portion of the electric supply network; and Hammersmith had similar experience one evening quite recently. So we might by reference to our own news columns and to those of our electrical contemporaries, compile quite a long list of instances of the unreliability of electricity as a public lighting agent. Surely Mr. Haydn Harrison should tack something on to his cost per candle power per annum for moral and other damage arising from these interruptions of street lighting, to say nothing of the inconvenience that private consumers are put to by having their houses "illuminated" only by candles. But candle light is better than no light.

Most solemnly the electricity station engineer in the leaflets he distributes tells the people in his district that electricity is the safest of all illuminants. Facts speak louder than bare assertions. There was a big blaze at Gamage's the other day in Holborn. The official report says "the cause of the fire is unknown." But according to one of the boys engaged by the firm, "just before the outbreak, there was a flash at one of the electric fuse boxes." We do not suppose the imagination of an office or shop boy could rise to the height of making up a tale of this kind, nor do we suppose that he entertains towards the electric light any particular ill-will, nor can we fancy that an office boy at Gamage's is a shareholder in any gas company. One of the managers of the establishment also thinks it probable the outbreak was due to the fusing of an electric wire. So that we may assume he is quite a disinterested party. Then we read in our morning's papers yesterday week that, on the previous Saturday, there was a fire at the motor show being held in the big hall of the Grand Palais in Paris. The place was electrically lighted, and diaphanous decorations were hung across the place. A short-circuit caused a blaze among these. The flames, to the consternation of the large crowd of visitors, took a rapid but picturesque course among the gauzy contributors to the gay scene. At the peril of their lives, plucky firemen mounted to the roof, and tore down the burning material, and so averted a catastrophe. On Nov. 18, a fire occurred at the South Ealing electricity works; but, says an electrical contemporary, there was no stoppage of the supply. At the recent meeting of the Imperial Continental Gas Association, the Chairman reported the destruction of a small electricity supply station in possession of the Association, and announced the intention of the Directors to in future insure their electricity plant, though the y have never found occasion to insure the valuable gas plants they possess on the Continent. At an entertainment recently at the Edmonton Town Hall, an electrical paper says that "one of the electric wires which had been laid for the occasion fused and took fire." Certain persons were injured; but the performance was afterwards proceeded with. On Nov. 13, a case was heard, by Mr. Justice Darling and a special jury, in which Thomas Samuel Harman sought to, and did, recover from

the Shoreditch Borough Council damages for loss sustained by a fire produced by an electric motor. The motor was alleged to have been totally unfit for the purpose for which it was required. The old suggestion was made that the fire was caused by someone smoking on the premises. But as the boy in the street says "that won't wash"—at any rate, always. The Court could not swallow it on this occasion; and the Council were ordered to find £2250 with which to solace the plaintiff. And station engineers unblushingly send round the message to householders and shopkeepers that electricity is innocent of fire risks!

HOW TO MAKE COALITE.

THE specification of Patent No. 17,347, dated Aug. 1, 1906, of which an abstract appears elsewhere in to-day's "JOURNAL," vouchsafes a little—but very little—more information as to the manner in which Mr. Thomas Parker essays to produce his partially coked fuel, yclept coalite. This patent is subsidiary to his earlier patent—No. 14,365, June 22, 1906—of which the specification was given in full in the "JOURNAL" for Oct. 8.

Now, according to his "invention" of the earlier date, Mr. Parker effected the destructive distillation of bituminous coal within a closed retort; and he maintained the temperature in the retort at about 800° Fahr. during the process of distillation. In less than six weeks, he had found it advisable to improve on the "invention" by applying to it another, which consists in gradually and slowly applying the heat to the coal. A temperature of about 800° Fahr. is no longer to be maintained within the retort during the process; but that is to be the maximum temperature, and "it will be understood that at the commencement of the process the heat applied is slight, and that it is very gradually raised so that the whole mass of coal under treatment may be uniformly heated and the heat is gradually and slowly increased." This is an important innovation for an inventor to make within six weeks of his original claim to an invention which Mr. F. D. Marshall has informed our readers "is no haphazard process, but a carefully studied and thought-out one—the result of years of patient and unremitting labour" (*ante*, p. 431). If it took years of labour to produce the first invention, at what high pressure must the inventor have toiled to achieve in less than six weeks his second invention, which involves so momentous a modification of his first. If this progressive rate of inventive fertility be maintained, days—nay, hours, or even minutes—will suffice for the whilom year-in-year-out toiler to evolve other discoveries destined to revolutionize one or other of the world's biggest industries. Six weeks is but a little while. In "Three Weeks" a modern novelist has shown that much may be perpetrated in as brief a space of time. Whether that much be good or evil, it would be invidious to discuss in the present connection; but to whomsoever may fall the happy lot of writing the romance of the discovery of coalite, we would suggest "Six Weeks" as a not inappropriate title.

It is often contended that persons who are cursed with the possession of a sense of humour never succeed in commercial or industrial pursuits; and if the converse proposition be true, coalite should prove a greater success than even the most serious of its numerous exploiters and sponsors has yet dared to anticipate for it. And the announcement in last week's "JOURNAL" that the British Coalite Company, Limited, have given notice of their intention to apply to Parliament for authority to construct gas-works, &c., at Barking, and to supply gas for power, heating, &c., in the surrounding districts, is evidence that the Directors of the Company are very serious persons indeed. London they conceive must have coalite; their Company have a monopoly of its manufacture; and all would be well were it not that there is a troublesome bye-product—gas—the sale of which is virtually a monopoly, now vested in other hands. Those who hold the monopoly for the sale of gas will have nothing to do with those who believe they hold a monopoly for the production of coalite, for obvious reasons. Since, therefore, the gas undertakings will not sell gas on behalf of the Coalite Company, the Company must try to break the monopoly, which Parliament has created, of the gas undertakings, in order to be in a position to sell gas on their own account. Now there are many fallacies in this train of reasoning, a few of which may be exposed with advantage.

The initial fallacy, of course, is that London must have coalite. The householder will perhaps consent to use it for domestic purposes, if it is offered to him at a considerably lower price than coal; otherwise he will continue to use coal where he now employs it, until he makes the radical change from solid to gaseous fuel. Should he, in a few instances, have a yearning for a smokeless solid fuel, he will find broken coke, carbo, and other similar gas-works products, smokeless coals, peat briquettes, and other materials, all ready to compete with coalite for his custom. Will the vaunted superiority of coalite carry it through this ordeal without resort to that cutting of the selling price by which the newcomer mostly seeks to gain a position among its market competitors? Among the latter in this case is one product—viz., gas coke—which cannot be suppressed, however bitterly the war of cutting prices may be waged. Gas coke is in better case than coalite gas (which bears the same relation to coalite manufacture as coke bears to gas manufacture), for the reasons that, thanks to water-gas plant, its production is controllable within wide limits, and that it may be sold unhampered by statutory regulations. If parliamentary sanction is ever secured for the supply of coalite gas, it may be surely predicted that the statutory obligations in respect of price, quality, uniformity, and continuity of supply will be so onerous that no bye-product of another industry will be capable of fulfilling them. These obligations will interchange the *rôles* of coalite and coalite gas; and the production of the former will become dependent on the demand for the latter. This brings us to the consideration of the probable prospects of coalite gas if ever the Coalite Company secure powers to supply it.

The Coalite Company appear to entertain the fallacy that the richness of coalite gas is an advantage. As a fact, under modern conditions of gas supply and use, it is a very serious disadvantage. Both Mr. F. S. Cripps and Mr. F. D. Marshall (*ante*, pp. 354, 431) condone that fallacy when they speak of coalite gas being available as an enricher of coal gas! Enricher, indeed! The poorest of coal gas is now almost too rich for modern requirements; and carburetted water gas and even uncarburetted water gas are freely used to reduce the quality of coal gas. If Mr. Cripps had referred to the South Metropolitan Gas Company before writing of them, he would have learnt that their lack of carburetted water-gas plant does not make them any the more likely users of other means of enrichment. They would doubtless prefer to coalite gas a convenient impoverisher. But if coalite gas is too rich for admixture with common coal gas for general supply, what are its prospects for power and heating purposes only? There its high illuminating value becomes a very grave disadvantage, as those who have tried acetylene, cannel gas, and oil gas for such uses know full well. Its benzol and other "illuminants," of course, may be extracted before it is supplied for power purposes; but we know nothing at present of the intentions of the Coalite Company in this direction, which is beset with many pitfalls.

Another grave fallacy into which the Coalite Company's Board appear to have fallen is that they have a monopoly of the manufacture of coalite. We do not think the results of Mr. Parker's six weeks' further toil, added to that of years of his patient and unremitting labour, have given the Coalite Company a property which will pass unimpaired the ordeal of a patent action in the Courts; but, in any case, what exactly is that property, and what is it worth? It merely consists solely in the right to manufacture a particular product of coal in a particular way—more or less ill-defined, and subject to apparently purposeless variations. If coalite as now supplied were submitted to carbonizing experts ignorant of Mr. Parker's methods, with instructions to find means of making it from coal, it may be predicted that they would have no difficulty in producing the material, and by a process economically and industrially sounder than that disclosed by Mr. Parker's published specifications. If the Coalite Company succeed in creating a healthy demand for coalite, they will simultaneously call into being other methods of producing such a material, for which as such they do not even claim to hold patent rights. It is open to the world to make a similar product to that of the Coalite Company; and if the demand for it arises, it will undoubtedly be made by less tedious, costly, and finicking methods. By whom? Perhaps the correspondents, to whose letters to the "JOURNAL" we have already referred, and "M.Inst.C.E." (*ante*, p. 501) and others, will assist to answer the question, but without the uncalled-for "heat" introduced in his last letter by Mr. Marshall in his references to "M.Inst.C.E." (*ante*, p. 648).

Effective Gas Lighting at Trades Exhibitions.

Trades exhibitions which have just been held at Folkestone and Reading afforded the Gas Companies in the respective towns opportunities, of which they did not fail to take advantage, for showing the capabilities of gas as an illuminating agent. At Folkestone, out of 28 stands in the exhibition, 23 were lighted by gas and the remainder by electricity, the body of the hall being illuminated by eight of the Welsbach Company's 600-candle power lamps. The Gas Company's stand was lighted in front by two Humphrey inside lamps of the "Standard" pattern, with one of the Lucas "Thermopile" lamps in the centre; the latter light coming in for a good deal of attention. The inside of the stand was lighted with brackets at the back and pendants in the centre, fitted with the Graetzin, Darwin, "Nico," and the Welsbach Company's new pattern pendant burners. A Crossley gas-engine, fitted alongside, was left running all the afternoon and evening. Owing to the keen competition between the Gas and Electric Light Companies, visitors were much attracted by the stand, which was very generally voted to be the best in the exhibition. The whole of the gas lighting, together with the fitting of the stand, was carried out under the personal supervision of Mr. W. O. Pritchard, the Manager of the Company's Fitting Department and Showrooms; and it proved a splendid advertisement to the efficiency of gas as an agent for lighting, heating, and the production of motive power. The other similar function was that of the Manufacturers' and Inventors' Advertising Company, who opened a trades exhibition in the Corn Exchange, Reading, last Tuesday, and it will remain open till next Friday. The exhibition calls for notice in our columns from the fact that it has afforded the Reading Gas Company an opportunity of making a fine display of gaslight. Moffat's Limited, of Farringdon Road, lent the Company ten of their 700-candle power "Lucas" lamps and one 1200-candle "Lucas-Thermopile" lamp, as used at the Manchester Exhibition; and they have been temporarily fixed in the Exchange, which has hitherto been lighted with flat-flame burners. The lamps are giving a very fine illuminating effect.

THE DESSAU VERTICAL RETORTS FOR GENOA.

An Independent Investigation of the Four and Five Metre Vertical Retorts.

THE Continental Union Gas Company (Union des Gaz) are determined to be quite up to date in plant and practice. Their new works at Milan and Genoa respectively are, and will be, models of perfection in equipment; and this will conduce in all departments to economy and efficiency. In gas-works in Italy, however, economy and efficiency do not, from the administrative standpoint, stand for everything; and policy has to be frequently guided by local circumstance.

Not by any means the least attractive feature of the new works at Genoa will be a bench of eight beds of ten vertical retorts on the Dessau system that it has been determined to erect; and the contract for which has already been entered into with the Stettiner Chamotte Fabrik Actien-Gesellschaft. Mr. Arthur F. Phillips, the gas engineering member of the Board of the Continental Union Gas Company, is particularly interested in this pending introduction into the manufacture of gas in Italy of the vertical system of carbonization; and from him we have obtained information as to the proposals of the Company, as well as particulars of their investigations into the question before adopting the system, and thus by adoption doing a part in helping it forward by gaining new and independent experiences under fresh conditions of operation. If this installation of eighty retorts answers expectations, then the plans for the new works at Genoa will allow of the extension of the system by other three benches of eighty verticals each. The retorts will be 4 metres long, as at Dessau, Cologne, and other places; and before we have finished this article, the reasons will be explained why the Company have determined to instal retorts of this length rather than 5-metre ones as employed by Herr E. Körting at Oberspree, and now in course of construction at Mariendorf. Before doing so, however, it will interest readers to know that the bench of eighty vertical retorts at Genoa is to be housed in an iron building, with simple brickwork panelling. The coal for charging the new bench (which will have a carbonizing capacity of about 80 tons a day) will be first dealt with by an outside coke-breaker, then elevated into the house, and passed through a screen for separation into large and small. The coal thus divided will be taken by two conveyors, and be delivered into partitioned hoppers over the retorts—the large coal on one side, and the small on the other. The idea is to feed the retorts by large and small coal simultaneously in two separate streams—the large on one side, and the small on the other. This plan of operation, it may be remembered, is Herr Körting's; and the advantage gained is that the gas evolved in the process of carbonization finds easier paths through the charge than when a mixture of large and small coal is put into the retorts in indiscriminate fashion—excessive pressure at the bottom of the retorts being overcome. On his visit to Oberspree, Mr. Phillips found this process of separation working exceedingly well, and answering fully the aim of its originator. He was also impressed with the saving of labour in carbonizing with vertical retorts.

Beyond this general statement, nothing more need be said at present about the bench of verticals that it is proposed to erect at Genoa, and the methods on which they will be worked; but it will be of more than passing interest to our gas engineering readers if we review the conclusions arrived at by the members of the gas engineering staff of the Union des Gaz who were commissioned by the Board of Directors to thoroughly inquire into the question. One very important conclusion was that, from the illuminating power point of view, the 4-metre (say 13 feet) retorts at Dessau gave better results than the 5-metre (say 16 feet) retorts at Oberspree. But in Berlin, illuminating power is of secondary importance; calorific power being the primary consideration there. In Italy, however, the Union des Gaz are obliged to supply gas which, by the consumption of 105 litres (about 3·7 cubic feet), will yield 1 carcel—that is to say, 9·6 candles. Such gas would, consumed under the British condition of 5 cubic feet, render an illuminating power of about 14 candles. The investigators therefore found that, by employing the 4-metre retort and Boldon (Durham) coal (which is generally used at the Italian gas-works), the standard of 105 litres per carcel could easily be complied with, and be supplemented by a good production of gas per ton; whereas, while a still greater yield of gas could be obtained with the 5-metre retort, the illuminating power was diminished to something like 12 candles.

Going with a little more closeness into the results of the inquiry made at Dessau and at Oberspree by the representatives of the Union des Gas, much that is interesting is found. At Dessau in the first place, tests were instituted with Lens coal. This is a coal good in its ammoniacal products, but indifferent in the illuminating power of the gas yielded. When nine and ten hour charges of this coal were employed, the coal yielded well in gas, but the illuminating power was low; and when eight-hour charges were resorted to, the lighting power improved, but the yield fell considerably. From what the investigators say, it is manifest that Pas de Calais coal (which becomes very soft, and is reduced to almost a pulp at the commencement of carbonization) is not good for either inclined or vertical working, owing to its tenacious adhesion to the retort sides, making their discharge a difficult matter.

When we come to Boldon coal, however, the investigators have something more satisfactory to say as to its carbonization in the 4-metre retorts. During a three days' test, the average illuminating power was equal to 1 carcel (9·6 candles) per 104·4 litres of gas, with an average yield of 316·3 cubic metres (say, 11,160 cubic feet) of gas per ton of coal carbonized. Frequent tests of the gas in the holders gave an average illuminating power of 1 carcel per 106·4 litres of gas. The investigators mention that the same coal in horizontal retorts yields on an average a gas giving 1 carcel for 105 litres, and a production of 305 to 308 cubic metres to the ton.* Therefore, according to these results, the 4-metre retorts at Dessau give from Boldon coal a gas of rather better quality and higher yield than horizontal retorts according to Continental experience. The investigators appear to have been somewhat astonished at the great difference in illuminating power that they found between the Dessau working with 4-metre retorts and the Oberspree working with 5-metre retorts; and they attribute this to the fact that at Dessau the beds are worked at an average temperature of 1300° C. above the generators, whereas at Oberspree the retorts are heated to a higher temperature. It is also considered that the fact that the gas remains in the 4-metre retorts a shorter time than in the 5-metre ones has also some influence in connection with illuminating power. A further observed point was that in the 4-metre retorts, an average of 1176 kilos of Boldon coal were carbonized per retort in twenty-four hours; whereas in the 5-metre retorts only about 1110 kilos were carbonized. It is therefore considered that there is no advantage in the 5-metre retorts in comparison with the 4-metre ones; and therefore, for Genoa, preference fell upon the 4-metre length.

Analyses made of the gas produced at Oberspree and Dessau gave the following results:—

	Oberspree.	Dessau.	
	Boldon. Per Cent.	Boldon. Per Cent.	Lens. Per Cent.
Carbonic acid	1·2	1·6	1·4
Hydrocarbons	3·9	3·6	3·2
Oxygen	0·0	0·0	0·0
Carbonic oxide	3·5	5·2	7·4
Hydrogen	58·5	52·4	50·8
Methane	31·4	33·4	31·9
Nitrogen	1·5	3·8	5·3
Illuminating power, litres to the carcel	131	104	135

The investigators call attention to the small proportion of carbonic oxide in the gas produced from Boldon coal in the vertical retorts both at Oberspree and at Dessau—seeing that the English coal carbonized in horizontal retorts gives from 7 to 12 per cent. One curious point about the foregoing table is that the gas obtained at Oberspree from Boldon coal, giving a low illuminating power, should contain more hydrocarbons than the gas at Dessau with the higher illuminating power.

Regarding the residuals, the investigators report that the coke produced, both by Boldon and Lambton coal and also by Lens coal, is of fine quality and hard. It is denser than ordinary gas coke, and has the appearance of metallurgical coke. This peculiarity in the coke might be an advantage in some cases, and a disadvantage in others. At all events, the coke sells very well both at Oberspree and at Dessau, where a better price is obtained for it than for the ordinary gas coke. The yield of coke per 100 kilos. of coal carbonized was (dried at 100° C.) for Boldon coal 69 per cent., and for Lens coal 68 per cent. Concerning the tar produced both at Oberspree and at Dessau, it is particularly liquid; and its brownish colour indicates that it contains more oil than the tar from ordinary working.

The investigators also present some interesting points respecting the working of the settings. For example, the average temperatures of the settings taken at the Oberspree and Dessau works, by means of a Ferry and Wanner pyrometer, were:

	Oberspree, 5 m.	Dessau, 4 m.
	Deg. C.	Deg. C.
Section below the retorts	1400 – 1260	1300 – 1290
Second section	1340 – 1210	1220 – 1230
Third section	1050 – 1010	1020 – 1240

The temperatures fell less rapidly in the 4-metre retorts than in those of 5-metre length; but, generally speaking, both at Oberspree and at Dessau, there was but little difference between the temperatures of one retort and another. The generators are cleaned every 48 hours both at Oberspree and at Dessau; and this cleaning is not difficult, if the construction of the generator is well understood.

Greatly struck were the investigators by the ease with which the vertical retorts are manipulated. The labour is much less arduous for the stokers than on beds of horizontal or inclined retorts. The discharging of the retorts is merely performed by a simple lever arrangement; and it gave them pleasure to see the whole contents of each retort come out in one run. The Union des Gaz have been chiefly influenced in deciding to make a trial of the vertical retorts by this reduction in labour, which is of the greatest importance in Italy. With this system of carbonizing

* In the volume of "Analyses of British Coals and Coke" recently published by the Chichester Press, Mr. John Pattinson, F.I.C., F.C.S., credits Boldon gas coal with a yield of 10,500 cubic feet of gas per ton of an illuminating power of 16·9 candles. This would be burning the gas at the 5-cubic feet rate, and (it may be supposed) in the old "London" Argand No. 1 burner.

coal at Cologne, Oberspree, and Dessau, the quantity of coal carbonized per man varies from 10 to 13 tons per day. During all of the experiments with English coal the discharge of the coke was perfect. It is true that the beds on which they operated were not old. Those at Oberspree were fired on Feb. 25 last, and those at Dessau the previous month. During their stay at Dessau, beds of the verticals were being dismantled; and the internal walls of the retorts were found to be still in good condition, and smooth. It is certain that the use of steam facilitates the extraction of the coke from the retort in view of the reduction of the formation of graphite in the lower portion. But Dr. Bueb states that he has worked for quite a long time without introducing steam into the retorts, and that he has never had any difficulty in withdrawing the charges, having exercised care in removing the graphite in proper time. The coke from the retorts falls direct into a De Brouwer conveyor, which takes it outside the house. At Oberspree, the conveyor is in front of the bed of retorts; while at Cologne and Dessau, it is directly beneath the retorts. The arrangement at Oberspree is considered by the investigators to be the preferable plan.

These interesting particulars of the investigation may be concluded by quoting the

Results of the Tests Made on the Beds of Vertical Retorts at Dessau with English Boldon Coal, without Steam.

	Aug. 11.	Aug. 12.	Aug. 13.
Number of retorts fired	20	20	20
Length of retorts, feet	13	13	13
Duration of carbonization (hours)	10	10	10
Temperature of settings at retorts, Fahr.	2372°	2354°	2372°
Cubic feet of gas produced per ton	10,700	10,983	10,983
Coal carbonized per retort per charge	1078 lbs.	1078 lbs.	1078 lbs.
Coal carbonized per retort per 24 hours	2587 lbs.	2587 lbs.	2587 lbs.
Gas produced per retort per 24 hours, cubic feet	12,360	12,925	12,925
Average lighting power, cubic feet to the carcel (9·6 candles)	3·764	3·668	3·623
Heating power per cubic metre (condensed steam) B.Th.U. per 1000 cubic feet	—	(say) 610,000	(say) 617,000

In all cases the charge was well carbonized, and the coke came easily out of the retorts.

WAGES AND HOURS OF LABOUR IN 1906.

THAT excellent indication of the state of trade, the labour market, has for a good long time past reflected the industrial expansion that has been enjoyed by this and other countries; and the fourteenth report of Mr. A. Wilson Fox, of the Labour Department of the Board of Trade, on the Changes in Rates of Wages and Hours of Labour in 1906, is therefore quite a satisfactory document. The net result of all the changes in the rates of wages reported to the department was an advance of £57,900 a week. The only two industries in which the total reported changes of wages in 1906 resulted in net decreases were the building and quarrying trades; and in these the decreases were only small in amount. This prosperous record is all the more gratifying when it is remembered that at the time of the issue of last year's report the industrial world was in a more or less unsettled state owing to disputes in the shipbuilding and coal mining branches and growing agitation among the railway workers; and, of course, it is not generally during disturbed conditions that any comprehensive increases in wages would be looked for. From 1900 to the middle of 1905, the movement in wages was a downward one; but a change then came over the scene, and the upward tendency which commenced in the second half of 1905 continued throughout 1906—the result being, for the first time since 1900, a total net increase in wages as compared with the previous year. During the first six months of the present year, the improvement has been even more marked; for we are told that wages have shown a greatly accelerated upward movement, and net increases have been reported in all groups of trades. Altogether, 1,150,000 workpeople are reported to have had their wages changed; and the net effect of all the changes is an increase of £107,800 per week, compared with a net increase of £26,600 per week in the wages of 843,300 workpeople in the corresponding half of 1906. It may be pointed out here that the report does not deal with changes in average earnings arising out of variations in the extent of employment obtainable.

To return, however, to the year dealt with in the report under notice, it is stated that, so far as the Department could ascertain, over 1,115,000 workpeople had their rates of wages changed in 1906. Of these, nearly 1,098,000 received advances amounting to £58,400 per week; while 5000 sustained decreases amounting to rather more than £500. The remaining 12,000 experienced both upward and downward changes, which left their wages at the same level at the end of the year as at the beginning; and the net result of all the changes was therefore an increase of £57,900 per week. This, it may be remarked, compares with a decrease of nearly £2200 a week in the year 1905. Calculating the effect of the changes in 1906 from the date at which they took place to the end of the year, the aggregate increase in wages due to them is computed at £1,419,000; whereas in each of the five preceding years, of course, the corresponding figure showed net decreases—£114,000 in 1905, £938,000 in 1904, £500,000 in 1903, £2,300,000 in 1902, and £1,600,000 in 1901. Curiously enough, the changes recorded for the ten years preceding 1906, show five years (1896-1900) of regularly growing increases, and five years (1901-1905) of gradually lessening decreases. Now 1906 has started again a period of increases in very substantial fashion; and it is to be hoped, inasmuch as good wages and general prosperity must go hand in hand, that the cycle so encouragingly begun will last at least as long as its immediate predecessor. It is true that, with the railway agitation out of the way, the practical settlement of the non-Unionist question among the South Wales collieries, the disappearance of the need for the threatened extensive lock-out in the shipbuilding yards, and the at any rate temporary postponement of hostilities in the cotton trade, there is at present no reason to fear disturbance through any great industrial struggle. But, of course, this is only one of the considerations involved in a question the answer to which depends also upon a great many other factors. Only last week, Sir Felix Schuster, in his Presidential Address to the Institute of Bankers, said that trade indications pointed to restriction rather than expansion, not only in this country, but all over the world; the development of trade having proceeded at somewhat too rapid a pace.

Last year the proportion of workpeople affected by changes of wages was largest in the coal mining industry—50·6 per cent. The districts principally affected were Northumberland, Durham, South Wales, and Scotland. The total number for whom changes were reported was 427,156; and the net amount of increase in the weekly wages is estimated at £27,188. Employment in the coal mining industry, which showed little variation in 1905 as compared with 1904, improved considerably in 1906; and the average weekly number of days worked by the pits was higher than in any year since 1900. In fact, the number employed was greater than any previous year. Wages were higher in most of the districts at the end than at the beginning of 1906; but in several the figures remained the same as previously. The effect of the changes in wages which took place in 1936 was a net advance of $8\frac{3}{4}$ per cent. above the standard (making the wages $23\frac{3}{4}$ per cent. above the standard) in Northumberland, of 5 per cent. (making $32\frac{1}{2}$ and 30 per cent.) in Durham and in the Forest of Dean, of $2\frac{1}{2}$ per cent. (making 30 per cent.) in the Radstock district of Somerset, of $7\frac{1}{2}$ per cent. (making $37\frac{1}{2}$ per cent.) in South Wales and Monmouthshire, and of $6\frac{1}{4}$ per cent. (making the wages $43\frac{3}{4}$ per cent. above the standard) in Scotland. In the Cumberland and Bristol districts a decrease, followed by an increase, left wages at the same level.

Turning to other branches of industry, the proportion of workpeople in the textile trades affected by changes in rates of wages in 1906 was 33·5 per cent., which was larger than in any year since the statistics were first collected. In the iron, &c., mining and in the metal, engineering, and shipbuilding trades the proportion was also large. Among miscellaneous trades, there are but three changes chronicled in the rates of wages of gas workers in company employ; the number of men affected being 408, and the net increase in weekly wages £21 12s. In fact, in not one of the past ten years has there been a net decrease in wages. Two instances of rises quoted for last year are Longwood, yardmen, 2s. a week, to 23s. and 24s.; and Sheffield, labourers, 1s. a week, to 24s. Coming to the local authorities, we see there were numerous changes at Carlisle. Changes in hours of labour resulted in decreases of 2s. 6d. a week, to 35s., for the exhauster enginemen, and 1s. 4d. a week, to 33s. 4d., for the ammonia plant men. But, on the other hand, gas makers had a rise of 3s. 9d. a week, to 56s. 3d., and boilermen, 5s. 6d., to 45s.; while labourers also enjoyed an increase in their pay of 1s. 9d. a week. In several other instances, also, there are rises recorded. Taking the employees of public bodies altogether—Government servants, workpeople engaged by local authorities, and police—29,290 persons received a net increase per week in their wages of £1629.

As to the methods by which changes in wages were arranged last year, 5·2 per cent., against 4·6 per cent. in 1905, were under sliding-scales; by Conciliation Boards, mediation, arbitration, &c., 37·1 per cent., against 44·4 per cent.; and by direct arrangement, negotiation, &c., 57·7 per cent., against 51 per cent. As in previous years, the number of persons whose changes were preceded by a stoppage of work formed an inconsiderable fraction of the whole—4·9 per cent., as compared with 2·1 per cent. in 1905. But in this calculation no account is taken of strikes for increased wages that failed, or of threatened strikes or lock-outs that may have influenced the changes in wages made. The changes in hours of labour recorded (which do not include temporary alterations in the working hours owing to variations in the state of trade) affected 54,954 workpeople, of whom no less than 52,969 had their hours of labour reduced. The net effect of all the changes was a reduction of 98,892 hours in the weekly working time of the persons affected.

According to the "Engineering and Mining Journal," the life of wooden pipes made up of staves is dependent upon the life of the bands holding the staves in place and resisting the internal pressure. By using galvanized wire bands, deeply embedded in the wood and thoroughly and evenly coated with asphalt, the life is materially prolonged. Experience has shown that the pipe is still serviceable, even when the sectional area of the banding is reduced as much as 60 per cent. by corrosion. Iron pipe is frequently unfit for service when but 5 per cent. of the metal has been corroded.

OBITUARY.

We regret to record the death, last Thursday afternoon, at his residence, "One Oak," Alderley Edge, in his 49th year, of Mr. FRANCIS H. ORME, Joint Managing-Director of Meters Limited, and a Director of the National Gas-Engine Company, Limited. Deceased was the eldest son of the late Mr. George Orme, and was a member of one of the Oldham families long connected with the meter-making industry; the firm with which his name was associated—viz., Messrs. George Orme and Co., of the Atlas Meter-Works—being one of the original constituent firms of the first of the above-named Companies. Mr. Orme, who was a widower, leaves two sons and two daughters. The funeral takes place this morning at Chadderton Cemetery, Oldham, where Mrs. Orme was interred two years ago.

A water engineer who was associated in this capacity for about forty years with the Halifax Water-Works has lately passed away in the person of Mr. JAMES ATKIN PASKIN. The deceased gentleman commenced his career in the office of the late Mr. J. F. Bateman in 1860, and took up professional work in Halifax in 1863 in connection with the Luddenden scheme. In 1876, he was appointed Superintendent of the water-works; and he held the position till 1901. He was, however, retained as Consulting Engineer for three years, at the end of which period he practically retired into private life, and took up his abode at Lytham. Outside his special sphere, he did good work in various ways for Halifax. He leaves a widow and one son.

A WATER-MAIN UNDER RAILWAY LINES.

In a recent number of "Engineering Record," particulars were given in regard to a rather troublesome piece of work carried out in connection with the improvement of the water supply of Trenton (N.J.). It consisted in carrying a 48-inch steel-main beneath the lines of the Pennsylvania and Delaware Railways, under conditions requiring special construction to protect the pipe from excessive pressures of earth and the jar of passing trains. The pipe, which was of the lock-bar type, was made of 5-16th inch plates, and was delivered in 30-feet sections, so as to reduce the field joints to the lowest number possible. Sleeve-hub and lead joints were used; and at all the bends these were reinforced with heavy cast-iron sleeves, put on over the regular sleeve, and caulked with lead in the usual manner.

For some distance the main was laid along a street which passes over the Belvedere division of the Pennsylvania Railway on a steel structure with stone masonry abutments. Here the pipe was carried through the lower part of the abutments and under the tracks, with its top about 3 feet below the base of the rails. Depressing the pipe below the tracks necessitated trenching from 10 to 27 feet in depth, both in approaching and in leaving the bridge. Where the depth of trench exceeded 10 feet, it was thought unwise to depend on the ordinary steel pipes to carry the weight of the back-filled material. A cast-iron pipe might have proved satisfactory where the depth of trench was excessive; but it was found that a steel pipe in a concrete tunnel would be no more expensive, and even more satisfactory, owing to the ease with which it could be inspected and repaired if necessary. The tunnel was accordingly made. It extends about 150 feet above and 300 feet below the bridge, and consisted of two heavy concrete walls carrying a 12-inch slab of plain concrete reinforced by 10-inch I-beams, except under the tracks, where a 15-inch I-beam was placed under each rail. Where the pipe passed through the opening at the bottom of each abutment, a concrete arch was sprung across the top of the opening as a precautionary measure. Access was had to the tunnel through a manhole under the bridge between the tracks, and through one at each end of the tunnel. The construction used in carrying the pipe under the tracks of the Delaware Railway was like that already described.

The connection of the new main with the reservoir was accomplished by inserting a stayed cast-iron Y-shaped special in the 36-inch ascending main within about 200 feet of the inlet. The leading end and one leg of the Y was to be the present line of main, and the other leg was to be connected with a 48-inch to 36-inch reducer, and then the 48-inch reducer was to be connected with the new ascending main. There was to be a gate-valve provided for each of the ascending mains immediately behind the Y, so as to permit the use of either main separately or both together.

We learn that the old-established firm of gas apparatus manufacturers in Germany—the Braunschweiz Dampfkessel und Gasometer Fabrik, of Brunswick—have made an arrangement with Messrs. Samuel Cutler and Sons, of Millwall, whereby they are enabled to take contracts for this description of plant, and carry them out in accordance with the designs and specialities which have been so successfully developed by Messrs. Cutler. Mr. Pallenberg, the Director of this branch of the concern, was for a considerable period on Messrs. Cutler's engineering staff in England; and we understand that the works under his supervision are being carried on with the advantage of the experience he gained while in their service. This should, we think, afford a guarantee as to the way in which contracts entrusted to the firm will be executed.

A MANUAL FOR GAS-WORKS' CHEMISTS.*

THE above heading represents what we think should be the title of the 300-page book before us, the author of which is Mr. Harold M. Royle, F.C.S., of Beckton. He has chosen to call it "The Chemistry of Gas Manufacture," which seems to us to be unfortunate in more than one respect. In the first place, it is the title that is already associated, and properly and most pleasingly associated, with a well-known book by Mr. W. J. Atkinson Butterfield, M.A., F.C.S. This first appeared in 1896, when Mr. Butterfield held the position of Head Chemist at Beckton. So useful and popular was it that early in this present year, a fourth edition was called for, and appeared under the title of "The Chemistry of Gas Manufacture"†. We think it a pity that now a second treatise should unnecessarily and confusingly have the same designation. But we regret this also for another and even stronger reason. The title of a book should afford some accurate idea of its subject-matter. We believe that for light fiction the choice of a title, or the colour of a cover, may be of far more consequence than the contents. Such a consideration does not apply to a serious technical work. But the title should indicate the contents; and Mr. Royle's "Chemistry of Gas Manufacture" is the chemistry of gas with the manufacture left out. "The author's aim," he says in his preface, "has been to confine the work strictly to certain aspects of the chemistry of gas manufacture, leaving the operations of manufacture alone." Let it be understood that we are not in any way complaining of the absence of matter dealing with manufacture, but merely with the use of the phrase, "the chemistry of gas manufacture," when all that is meant to be included are some chemical aspects of the materials used in, or products resulting from, the manufacture of gas—not the manufacture itself.

What, then, is the book under review? It is a useful collection of chemical recipes that will no doubt prove of value in gas-works' laboratories; but we must express our opinion that it will only be really useful in competent hands, directed by properly qualified heads. This is, indeed, a compliment to the author; for the perusal of his book has left us with an impression of his own competency as a chemist; and we think that the information he imparts necessitates a fairly high degree of knowledge and efficiency for it to be appreciated properly. This, of course, carries with it its own limitations. The object of the volume has been "to furnish the working gas engineer and manager with a concise manual . . . especially in those gas-works where the operations are not of so great an extent as to necessitate the employment of a separate chemical staff." Our fear is, however, that the busy and chemically unaided gas manager will hardly have the time and training required to carry out many of the tests recorded in the book. Much less, we think, will ordinary students of gas manufacture be able to understand and execute them, though purely chemical students will no doubt be able to master the matter more easily. Far be it from us to dissuade the younger generation from attaining to this standard of chemical efficiency; but Mr. Royle's compilation is not a first, nor even a second, step in the science. It is for this reason that we have selected the title of "A Manual for Gas-Works' Chemists" for this review, as more clearly indicating the class of worker to whom we think the volume will particularly appeal.

We have said that the book is a collection of chemical recipes, a compilation of instructions for the estimation and analysis of gas-works' materials and products. That being so, it is not easy, nor probably of much interest or utility, to attempt a summary or digest of the contents. A few points may, however, be noticed. After dealing in the opening chapter with the preparation of standard solutions, coal is, naturally enough, the first material examined, classified, and analyzed—Mr. J. Paterson's "Lithology of Gas Coals" being quoted. To ascertain the moisture in coal, the faulty method of weighing and drying in the water oven is exposed; and the proper way of passing dry air over the coal and absorbing the moisture in a tube containing calcium chloride is described. The chapter concludes with descriptions of the Lewis Thompson and Mahler-Donkin calorimeters, as used for estimating the calorific value of coal or coke.

Chapter III. deals with the testing and regulating of furnaces. It is practically impossible to consider the chemical side of retort settings and furnaces without to some extent also entering upon constructional questions. A brief description of the three types of retort heating—direct, generator, and regenerator—is therefore given; but the illustrations (figs. 10 and 11) of sectional views of retort furnaces, without any lettered explanations or arrow indications, cannot be of much assistance to anyone. Either more or less should have been described and illustrated. On p. 44 we read: "Faulty heats can rarely be improved by increasing the damper (*sic*); they should rather be remedied by proper adjustment of the primary and secondary air, and attention to the clinkering and pricking-up of the fire." Five pages further on we are again told, "It is never advisable to control a setting by the use of the damper, but rather by the proper adjustment of the primary and secondary air inlets." Some heat and combustion recorders and pyrometers are shown and their working explained.

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* "The Chemistry of Gas Manufacture: A Practical Manual for the Use of Gas Engineers, Gas Managers, and Students." By Harold M. Royle, F.C.S., Chief Chemical Assistant, Beckton Gas-Works. With numerous illustrations. London: Crosby Lockwood and Son; 1907. [12s. 6d. net.]

† See "JOURNAL," Vol. XCVII., p. 338.

The chapter on "Products of Carbonization" contains extracts from the works of Mr. Lewis T. Wright, Mr. G. E. Davis, Mr. James M'Leod, Mr. W. Irwin, and a six-page list (compiled by Lunge) of coal-tar compounds. Among the products of carbonization is included sulphate of ammonia, but very little is said about it, and it seems to us that a more suitable place for this little would be in the chapter (VII.) devoted to ammonia. A short chapter deals with the estimation of the following impurities found in crude coal gas—that is, after leaving the condensers:

Ammonia	about	300 grains	per cubic foot.
Carbonic acid	,,	1800	,, ,,
Sulphuretted hydrogen . . .	,,	1050	,, ,,
Carbon disulphide	,,	70	,, ,,
Other sulphur compounds . .	,,	10	,, ,,
Cyanogen as hydrocyanic acid .	,,	106	,, ,,

The last named is fully considered, and also later in the chapter on ammonia, under the headings of cyanide, ferrocyanide, and thiocyanate.

The analysis of lime is next mentioned, and Mr. H. Leicester Greville's (*not* Grevelle) article* in the "JOURNAL" for Oct. 17, 1905, is laid under contribution. Similarly, also, with regard to oxide of iron, the same gentleman's experiments recorded in the "JOURNAL" for Sept. 19 (*not* 14), 1905, are referred to.† In the chapter on "Naphthalene," the "only two methods which have met with any amount of success" for testing for it—namely, the Colman-Smith test and the Dickenson Gair test—are fully described from papers read before the Society of Chemical Industry. Then the different methods in use for the removal of naphthalene are cited, chiefly from matter previously published in the "JOURNAL." The author concludes that "up to the present there does not appear to be any universal solvent or method that will cure naphthalene troubles in any town, for it is apparent that the process that meets with success in one place may fail altogether in another district."

After naphthalene, Chapter X. deals, curiously enough, with "The Analysis of Fire-Bricks and Fire-Clay." Surely this subject would have been more in place in connection with furnaces (Chapter III.). As it is, it is sandwiched between naphthalene and photometry, with neither of which has it anything to do. The analysis of Weldon Mud and spent oxide is also pitchforked into the same fire-brick department, when one might have more rationally expected to find such an analysis embraced by the previous Chapter VII., dealing with oxide of iron. Had this been done, the two charts showing the sulphur absorbed by oxide and Weldon Mud respectively could have been adjacent one to the other. After photometry and gas testing, the final chapter relates to carburetted water gas. An appendix in three parts gives the "Notification" of the Gas Referees for the year 1907; a few excerpts from various technical journals; and the usual tables and comparisons.

We have said enough—probably too much—to show what manner of book this so-called "Chemistry of Gas Manufacture" is. We have already pointed out what seem to us glaring defects in arrangement. The book wants re-casting. The author's style of writing is frequently involved or slovenly. The following sentence (p. 46) is not conspicuous for its lucidity, nor would its instructions be readily understood by a student seeking the determination of carbon dioxide (CO_2):

"The producer gas to be analyzed is first passed into the first pipette, which contains potassium hydrate and will absorb the carbon dioxide, by opening the cock connecting this pipette with the main four-way piece and raising the levelling bottle, which drives the gas from the burette into this pipette, displacing the reagent in the front part of the pipettes, leaving bare the capillary tubes, which, being covered with the reagent, present a large surface to the gas."

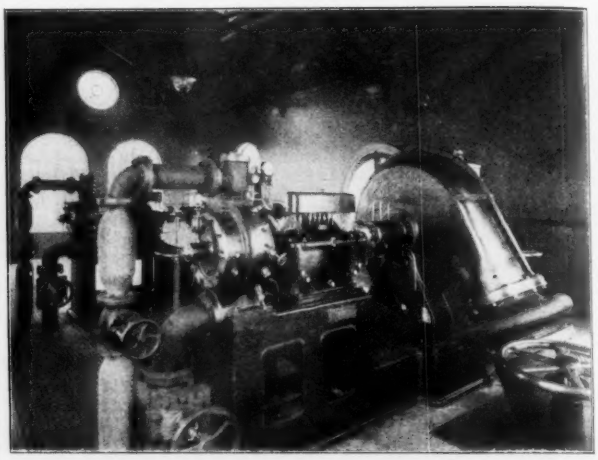
The second sentence in the book is: "The most generally used of (*sic*) standard solutions are given here, and how to make them." The last sentence (p. 238) reads: "Oil-gas tar . . appears to be probably the most effective, economical, and most expeditiously applied dust preventive (*sic*) treatment yet utilized in a practical way over large areas." Between these two faulty sentences are to be found many infelicities and inaccuracies—*e.g.*, "to impress the necessity" (p. 31); "these flues go down the side of the setting and they exit (*sic*) at the bottom" (p. 43); "the residue remaining after the evolution of carbonic acid, and which (*sic*) has not been dissolved" (p. 108); "Mr. Coulson, of Leicester," meaning of course, Mr. Colson (pp. 162 and 3); and "napthalene" for naphthalene (in index, p. 324). Many other examples might be given. The author asks in his preface "for any practical suggestion for the improvement of the work . . . with a view to future editions." We therefore suggest: (1) Change of title; (2) re-arrangement of matter; (3) correction of errors; (4) verification of references; (5) addition of bibliography; (6) expansion of index; and (7) improvement of style.

* See "JOURNAL," Vol. XCII., p. 173. † *Ibid.*, Vol. XCI., p. 750.

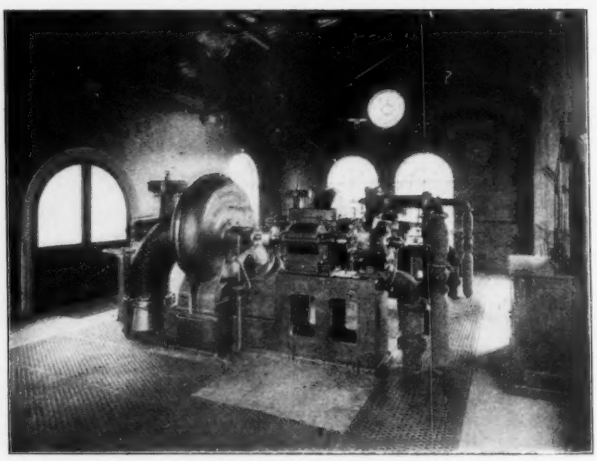
Yorkshire Junior Gas Association.—We learn from the Hon. Secretary (Mr. Charles T. B. Roper) that the next meeting of the Association will be held on Saturday afternoon, at the Leeds Institute. Mr. J. H. Hill, who, as mentioned elsewhere, has just been appointed Secretary and Manager of the York United Gas Company, will deliver his Presidential Address, which will be open for discussion by the members.

BOOSTING PLANT AT CROYDON GAS-WORKS.

Two of the illustrations for the article on the extensions of the Croydon Gas Company's works (published last week) came to hand too late to be included. We therefore publish them this week. They picture the two splendid boosting plants that have been laid down—each set comprising a 70-H.P. De Laval



Turbo-Boosters, showing the Turbines.



General View of the Turbo-Booster Plant.

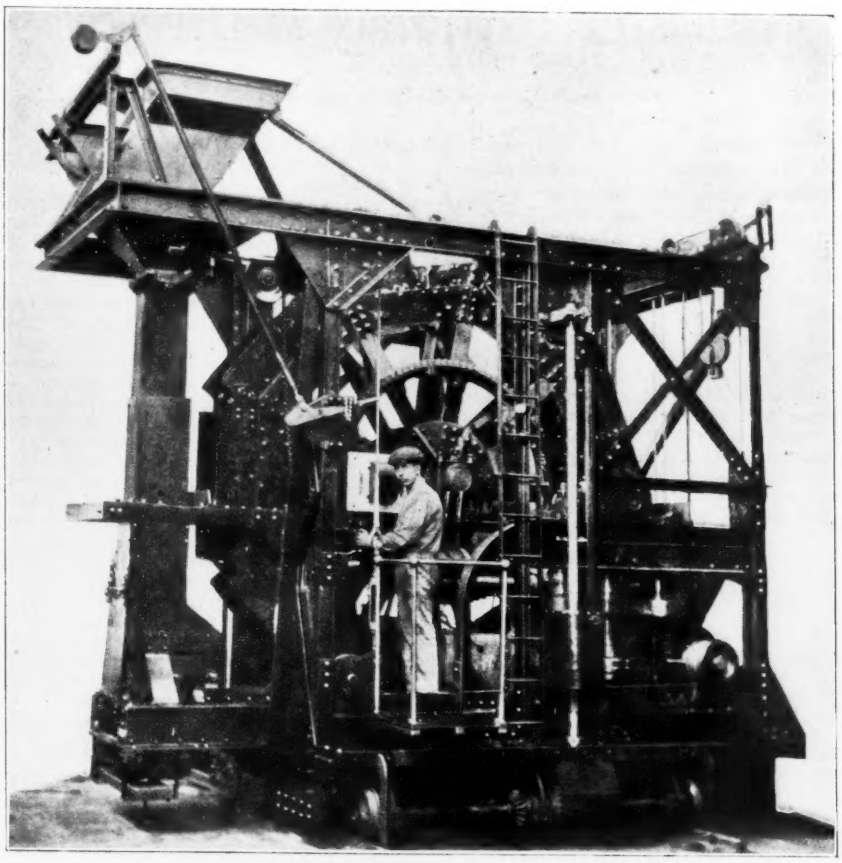
turbine and a Sturtevant blower, and capable of dealing with 750,000 cubic feet of gas an hour. The gas is conveyed to the plant by a 30-inch main; but the plant is only brought into action when a heavier pressure than ordinary is required—a bye-pass arrangement being employed at other times.

FIDDES-ALDRIDGE MACHINE AT WREXHAM.

REFERENCE is made elsewhere in this issue, in connection with the Manchester District Institution of Gas Engineers, to the Fiddes-Aldridge machines which are in operation at the Liverpool United Gaslight Company's works; and as a supplement to this, it is interesting to be able to give an illustration (p. 699) of one of the same machines just installed at the Wrexham Gas-Works. It contains several small improvements; and the great success which it is said to have been, demonstrates the utility of the machine for small works. We are informed that the Engineer and Manager (Mr. J. Braithwaite) is working more economically at Wrexham than has been found possible at Liverpool; and the suggested explanation of this is the employment of twelve-hour in place of eight-hour shifts, and the use of heavier charges—from 8 to 10 cwt.

PROJECTED WATER LEGISLATION FOR 1908.

So far as can be inferred from the abstracts, in the last and present issues of the "JOURNAL," of the notices which have been given for Bills relating to the supply of water, the coming session does not promise to be a very exciting one, though it will not be devoid of interest. With the transfer of the undertakings of the Water Companies to the Metropolitan Water Board, there has



The Fiddes-Aldridge Stoking Machine at the Wrexham Gas-Works.

of late years been a period of comparative peace, so far as London is concerned, though there were several skirmishes last session over the Board's Bill for the unification of the charges. That measure, however, as well as a General Powers Bill, was successfully carried through; and it may be assumed that the Board will not be in Parliament again until they have formulated the scheme foreshowed in the important report of the Works and Stores Committee which (as mentioned last week) is now under consideration. As, therefore, the Metropolis will not make any contribution to the water legislation of 1908, we will turn to the Provinces, and glance at the proposals emanating therefrom.

One of the largest water schemes to come before Parliament next session will be that of the Monmouthshire County Council, who will apply for authority to construct works for bringing into the Administrative County water collected from the Grwyne Fawr and its tributaries, in Brecknockshire, and selling it to local authorities and companies who are now supplying water under parliamentary powers in the area within the jurisdiction of the Council. This is rather an ambitious project; and it will be interesting to see how it is regarded by the parties who will be affected by it. Another proposal from Wales is that of the Merthyr Tydfil Corporation, who are desirous of constructing water-works in the counties of Brecknock and Glamorgan. As, however, the Pontypridd Water Company have their eyes on the same counties as sites for additional works, and the Rhymney and Aber Valleys Gas and Water Company intend to ask Parliament to allow them to take the water of two springs in the second of the counties named, it may be assumed that both Companies will have something to say on the subject. It is proposed to constitute and incorporate a Water Board for Llanelly and Burry Port, and include upon it representatives of the Ammanford Urban Council. But as the Council are themselves going to enlarge their existing works, and take water from the river to which the proposed Board intend to go for their supply, the two Bills may possibly give rise to interesting work in committee. Among other Welsh schemes are those of the Briton Ferry and Criccieth Urban District Councils—the former to extend their area by taking in a part of the borough of Aberavon, and the latter for the acquisition of the undertaking of the local Water Company. On the whole, it would seem that Wales is to be the battle-ground of the session, so far as water legislation is concerned.

Of the new works proposed in England (none of them are of great magnitude), perhaps those for Lincoln call for first notice, as the Corporation are seeking to improve the water supply of the city, which, as is well known, has given them some trouble, by the construction of a well and pumping-station in the rural district of East Retford. They will also ask for an extension of their limits of supply and for authority to increase their rates. The Burnley and Rochdale Corporations wish to construct reservoirs and other works; the Manchester Corporation are desirous of carrying out some extensions in Longdendale; and the Bridgford Urban District Council will not only apply for power to build water-works, but also to acquire from the Corporation of Nottingham the portion of their undertaking within the Council's district. Extensions of time for the completion of authorized works will be asked by the Bury and District Joint Water Board, and the Keighley, Leicester, and Stockport Corporations.

An unusual and somewhat complicated transfer of works is projected between the Blaydon and Ryton District Councils, the Weardale and Consett Water-Works Company, the Newcastle and Gateshead Water Company, and the Consett Iron Company, Limited. Assuming that the transfer is effected, the obligations of the Councils with respect to the supply of water will cease, and they will be conferred upon the two Water Companies. The Liverpool Corporation will seek relief from their existing obligation to supply water in St. Helens, Widnes, and Warrington. The South Lincolnshire Water Company, on the other hand, will apply for power to extend their limits, and purchase the undertaking of the South Lincolnshire (Fen) Water Company. Other purchases proposed are the undertakings of the Skegness and Slough Water Companies, by the Urban District Councils of these places. A Company is to be incorporated for the construction of works and the supply of water to Holderness; and the South-West Suburban Water Company wish to consolidate and convert their existing capital and raise more. The Audenshaw and Saddleworth Urban District Councils are desirous of joining the Ashton-under-Lyne, Stalybridge, and Dukinfield (District) Water-Works Committee.

The applications for Provisional Orders do not call for more than brief notice. A Company is to be formed for the supply of Elloughton-with-Brough; the Burgess Hill Water Company wish to extend their limits; and more capital is required by the Sevenoaks and Stourbridge Companies. Under the Private Legislation Procedure (Scotland) Act, 1899, applications will be made by the Falkirk and Larbert Water Trustees, the Lanarkshire (Middle Ward) District Committee, and the St. Andrews and Troon Town Councils, for authority to construct works, and by the Lanark and Motherwell Town Councils for extensions of their limits of supply.

If a project for which the Commissioners of Works and Public Buildings are about to seek the sanction of Parliament should be carried out, the Institution of Civil Engineers will be ejected from their old quarters. The Commissioners will apply for authority, for the purposes of, or in connection with, the extension of public offices in the City of Westminster, to acquire, by compulsory purchase or otherwise, certain lands, houses, &c., on the north side of Great George Street, including the building owned and occupied by the Institution.

MANCHESTER INSTITUTION AT LIVERPOOL.

Gas-Works Inspection under Difficulties.

On attempting to look out upon the streets of Liverpool last Saturday morning, they were found to be shrouded in a dense fog; and misgivings arose as to the compatibility of dense fogs and gas-works inspections, for this was the day when the Chairman (Mr. H. Wade Deacon, J.P.) and his colleagues—of whom Mr. William King is one—on the Board of the Liverpool United Gaslight Company had extended their hospitality, and thrown open their works, to the members of the Manchester District Institution of Gas Engineers, of which body Mr. Edward Allen, the Engineer-in-Chief of the Company, is a member, and now a Committeeman. But the fog, bad as it was, was not an altogether evilly-disposed fog; it had the graciousness during the day of varying its density, so that at times one could see more that was to be seen than at others. Still, when it was dense it was most uncomfortable, and it started in the morning by disorganizing traffic, so that the members turned up after eleven o'clock at Lime Street Station in batches, instead of in one whole body—some, in fact, from the more distant parts of the extensive territory of the Institution did not arrive in time to participate in the first part of the day's programme. But all took what could not be helped with good grace. Though there were other things to make the day memorable, all will agree that this particular fog was alone sufficient to stamp the visit to Liverpool indelibly in memory's pages.

However, Mr. Allen was at the station to meet the party, or as many as put in an appearance at the appointed time; and throughout the day he was a charming cicerone, a safe pilot through besetting dangers, and a genial representative of the hosts of the Institution.

Special tramcars conveyed the party from Lime Street Station first to the Eccles Street Gas-Works. Let us preface our account of the inspection by saying this: In equipment, the Liverpool Gas Company's works are well up-to-date; but, like most works that have been developed and modernized within themselves, there are traces of the past intermingled with the present. But there are few gas-works that, within their own walls, embrace so much that is of interest. All praise must be accorded the Company for the part they are taking in the testing and proving of modern inventions—particularly just now in the trial of the Woodall-Duckham continuous carbonization system in vertical retorts, and what is known as the methane-hydrogen system, and (this has passed the trial stage) in the adoption of the Fiddes-Aldridge simultaneous retort discharger-charger. Just consider the variation of systems of gas manufacture to be inspected on the Liverpool Gas Company's works. There are horizontal retorts charged by Arrol-Foulis and Fiddes-Aldridge machines, there are inclined retort-settings, there is continuous carbonization in the vertical retorts, there is carburetted water-gas manufacture, and the methane-hydrogen system. From this it will be seen that perpetuation of antiquity is not part of the policy of the Liverpool Company in their manufacturing operations. But here we are on the Eccles Street works; and Mr. Allen's staff of officers extend a personal welcome with the same heartiness that had already been displayed by their chief. During the day, the whole of the staff took charge of parties of the Institution members while on the works; and we will discharge at once the duty of acknowledging their indefatigable services in guiding, and rendering information to, the visitors. The gentlemen referred to were Mr. R. Gibson, the Assistant-Engineer of the Company; Mr. C. J. M'Ewen, the Manager of the Linacre works, and Mr. J. Charnley, his assistant; Mr. T. Godden, the Manager of the Wavertree works; Mr. R. Carter, the Manager of the Garston works; Mr. G. Haynes, the Manager of the Caryl Street works; Mr. E. Astbury, the Manager of the Athol Street and Eccles Street works; and Mr. E. Allen, jun.

Round the Eccles Street Works—The Fiddes-Aldridge Machine—Photographing Illuminating Power and Pressure.

Divided into parties, inspection was made of the works. All that was seen (the fog by this time had temporarily lifted somewhat, and so inspection was made under rather better circumstances than had been expected) does not call for notice here, as some extended extracts are made elsewhere (pp. 705-8) from a souvenir prepared by Mr. Allen. We will therefore confine ourselves to a few matters which were especially noteworthy. The Eccles Street works, it was found, fully occupy the ground here in the possession of the Company; so there is no room at all for further extensions. But productive capacity has, by the application of modern plant and practice, been largely increased from what it was originally. In the retort-houses, the total superficial space occupied by the regenerative settings is not so great as was the case with the old direct-fired settings, but the volume of gas produced is a great deal larger. Another effect of modernizing is seen in the fact that the benches in the house are not set centrally; this being both permissible and convenient by the application of only one machine to perform the double functions of clearing and charging the retorts—the deeper space being on the side of the benches where the machine runs, the less space on the side where discharging is performed, and the coke has to be dealt with.

In this house is seen the Fiddes-Aldridge machine—the second one put in at Liverpool; and only the second of a series that good result has prompted the installation of in the Company's works. This machine is an improvement on the first adopted at Wavertree; those that will in future deal with the horizontal retorts at Linacre will embody some still further improvements. Many of the visitors on Saturday saw this type of machine working for the first time; and there were many evidences of surprise. To look at a photograph of the machine, the big wheel with the big discharging-charger chain wound round it gives the machine a somewhat ponderous appearance, and one associates with a ponderous looking machine clumsy operation and clanking noises. But it is a case where appearances are deceptive; and many were the expressions of surprise at the unostentatious but definite way in which the machine performed its dual operations. No noise, certain and smooth working, level charges, and the coke expelled in good condition, are of the favourable points of the machine. The machine, however, is intended to compete with others in the matter of carbonizing costs; but Liverpool must not, at the present stage, be taken as any guide in the matter. There are many conditions inherent to the working of the present installations to account for a higher cost than that to which Mr. Allen is confident of getting down at the Linacre works when he can give the new machines there a sufficient amount of work to do. The machine at Eccles Street has not at the present time enough work to realize the utmost economy; and it has to work there on light and short-hour charges. The latter is traceable to the high illuminating power supplied by the Liverpool Company. Cannel has to be largely used; and unless a breaker is employed that will reduce cannel to a fine size, the machine will with heavy charges pull part out on its return stroke. But with ordinary coal, heavier charges can be worked; and the amount of the carbonizing wages can be much reduced. Under the conditions of only one bench at work, the light charges, and the hand wheeling of coke, the cost of carbonizing wages from incoming coal to the coke heap is 11·4d.; but when the house is fully employed, the average cost will be 9d., and under the conditions at Linacre, Mr. Allen is estimating a reduction of cost to something approximating 6d. The generating plant for the electricity used for driving and propelling the machine was inspected with interest, and other purposes for which electrical energy is used were inquired into.

The use of carburetted water-gas tar oil for the reduction of the naphthalene trouble appears to be spreading in gas-works. Last week we were noticing its employment at Croydon under certain conditions of temperature for the special purposes of withdrawing naphthalene and preventing solid deposition of naphthalene; not long since its use at Stockport was referred to; and now at these works it is found that a Walker washer with carburetted water-gas oil tar floating on the water, realizes good effect. The naphthalene is brought down from about 13 to 6 grains; and this has, Mr. Allen tells us in his souvenir, reduced the number of stopped street lamps from between 2000 and 3000 to 20 or 30.

Going up into the laboratory, we see a novelty in the matter of records. It is Messrs. M'Ewen and Gibbons's invention, whereby pressure and illuminating power are photographed. The apparatus employed is a jet photometer, giving a certain light and a certain pressure with a certain length of flame. The light passes through a slot on to a sheet of bromide paper carried on a drum revolved by clockwork. Suspended in front of the slot is a strip of tin connected to a King's gauge, by the action of which any variation in pressure is recorded on the bromide card. The pressure is shown by a white line. A white line towards the bottom of the card is equal to 20-candle power. This line is fixed; and any variation above or below means that the gas is below or above 20-candle power. This is all seen on the bromide card being developed in the ordinary manner of a bromide photograph. This ingenious invention for keeping a photographic record of illuminating power and pressure on one paper is used at, we believe, nearly all, if not all, the Company's stations.

Luncheon.

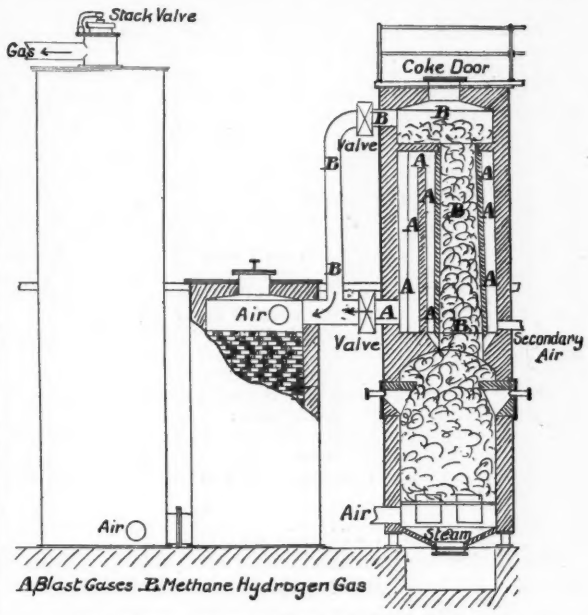
In time to reach the Exchange Station Hotel by one o'clock, the special tramcars left Eccles Street Gas-Works. At the hotel, the members enjoyed the hospitality of the Chairman and Directors of the Liverpool United Gaslight Company. It was a matter of general regret that the Chairman (Mr. H. Wade Deacon, J.P.) was unable to be present; but he had an excellent deputy in the chair in the person of Mr. Allen. To the right-hand side of Mr. Allen sat the President of the Association (Mr. W. Prince, of Stoke-on-Trent) and one of the Vice-Presidents (Mr. T. Duxbury), and to the left the Hon. Secretary (Mr. H. Kendrick). By this time, the visitors had all assembled; and notwithstanding the difficulties of travelling through the fog, of 110 expected guests (including the staff of the Company) there were 101 present. This was evidence, under the atmospherical drawback, of the attractions of the Liverpool works for the members. It should

be mentioned that among the guests was the President of the Wales and Monmouthshire Institution (Mr. Edward Jones). The luncheon was greatly enjoyed; and there was only one toast (thanks to the hosts being reserved for the meeting later in the day) in which loyalty to the King was once more proclaimed.

At the Linacre Works—The Vertical Retorts and the Methane-Hydrogen Plant.

By the time luncheon was finished, the fog had again thickened. But the programme had to be gone through; and the chief feature of interest—the one that many of the members wanted to see above all things—was awaiting inspection at Linacre. The party passed over to the Exchange Station for the purpose of going by electric train to Marsh Lane, which is the most convenient station for the Linacre works. What with the home-going crowd and Lancashire lads bent on footballing, there was a bit of a scramble to board the train, and somewhat of a crush when one did get aboard—the hundred or so stalwart Lancashire and Yorkshire gas engineers making a not inappreciable addition to an already congested condition. But eventually the Linacre works were reached; and again there was a division into parties. Reference must be made to the souvenir for the details of the plant—remark here being confined to special features. It was seen that there is spare space at these works for extensions. In passing, it was noticed that the works incorporate three coal-testing plants. But two of them, we fancy, are now kept more for historical association than for any particularly useful purpose. There is the 2·24 lbs. coal-testing plant that Mr. Alfred King employed in the years long since gone; and in an adjoining building is a complete, but old-fashioned, plant, from retort to holder, that has been discarded for the fine experimental plant now standing elsewhere on the works. Adjoining the last-named experimental plant are the two sets of four Woodall-Duckham vertical retorts, also referred to in the souvenir, and in the remarks by Mr. A. M. Duckham at the business meeting later in the afternoon. The top of the settings is merely covered in by a galvanized sheeting, for sheltering the operatives and the charging arrangements; and this demonstrates how little is required by these retorts in the nature of a building. But it was the first time that many of the members had seen retorts 25 feet long standing on end, and being continuously mechanically charged and discharged. Up the spiral stairway to the top of the retorts went most of the visitors to witness the noiseless and simple method of charging the retorts by coal raised by gravity-bucket conveyors, and deposited into hoppers feeding into the revolving circular charging-drums. And down to the ground level they went again to see the coke being removed from the retorts by means of the pusher and conveyor. The conveyor and the water-seal have, notwithstanding improvement from time to time, been recognized by the joint inventors as the weakest of the components of the system. But by the aid of a piece of chalk and the broad surface of a ⊢ iron standard, Mr. Duckham explained to an admiring and interested crowd of professionals how the conveyor and the water-seal have been abandoned in a setting at the Poole works of the Bournemouth Gas and Water Company, and a new arrangement applied which will be used in future installations. Without going too closely into the detail of the new system of removing the coke, it may be generally explained that there is a hopper at the bottom of each retort with a sloping bottom; and, at the lower part of the slope, there is a pronged roll, which makes a certain number of revolutions per hour, and rakes out the coke into a drum hopper beneath. This will sufficiently describe the change for the present; and it is a change that the inventors are satisfied achieves all they have been working for. Water is sprayed in at the top of the hopper with the sloping bottom for quenching the coke. A box of unselected coke—a fair sample of the whole Mr. Duckham assured us—had been sent up from Poole for inspection, to show the effect of the new discharging arrangement. It was a dry, bright, and hard coke, and of good size. The party lingered long round the installation, until all must have been fairly well acquainted with principles, parts, and working.

One of the other places visited was the large carburetted water-gas plant. One of the sets has been converted to the methane-hydrogen system; and near to it, Mr. C. B. Tully, by the aid of a blackboard, on which he had sketched (as reproduced here) a section of the methane-hydrogen plant, explained the changes made in conversion and the objects achieved. What was understood is that the object of the application of Tully's methane generator to an existing carburetted water-gas set is to economize fuel, and utilize tar in the generator for the production of methane-hydrogen gas in place of blue water gas as a carrier for the oil gas generated in the carburettor, and fixed in the superheater. It was pointed out by Mr. Tully that the temperature of the carburettor and superheater is controlled in an ordinary carburetted water-gas set by the supply of air and the combustion of the blast gases in the carburettor—more or less being used as the temperature of the carburettor or superheater requires. The air supply to the superheater is very seldom used. Consequently, when there is an excess of temperature in these vessels, there is always a waste of combustible blast gases at the stack-valve, resulting in an unnecessary waste of fuel. In the methane-hydrogen generator, this gas, instead of going to waste, is used for heating the retorts in the upper part of the generator—that is to say, any excess of blast gases is utilized for useful work. The alterations to the carburetted water-gas set consist of adding 12 feet to the length of the existing generator, and erecting a coke-charging stage.



The Methane-Hydrogen Water-Gas Plant at Liverpool.

The generator is divided into two sections; the lower portion being used as before as a producer, and provided with three tar-injectors with pockets in the side of the generator. In the upper portion three vertical retorts, are fitted, supported by means of arches sprung across the generator. Around the bottom of the retorts are nostrils for the escape of the blast gases round the outside of the retorts; and just above the nostrils the blast gas meets the secondary air supply for the combustion of the gas for heating the retorts. The blast-gas A passes up round the retorts, down through a flue, and away past the lower valve into the carburettor. Here the remainder of the blast gases are burnt by the admission of air necessary for raising it and the superheater to the required temperature. During the blowing period, the upper valve is closed, causing the blast gases to pass round the retorts instead of through them. For gas making, the lower valve is closed, and the top valve opened, causing the methane-hydrogen gas B to

The Methane Hydrogen Water-Gas Plant at Liverpool.

pass up through the retorts, and about 14 feet of incandescent fuel. Steam is admitted in the usual way; and tar injected into the fuel is gasified, and then fixed on its passage through the hot fuel in the vertical retorts. This gas, which has an illuminating power of about 8 candles, passes into the carburettor and mixes with the oil gas produced in that vessel. A flame produced by methane-hydrogen gas was shown to the visitors by Mr. Tully in the course of his description; and he explained that this gas was produced from a gallon of oil-gas tar per 1000 cubic feet.

After being interested by Mr. Tully, the party once more turned out into the dense fog. What was to be seen outside—such as the weighing-machines over which the coal is received from the contractors, and by the recorded weight of which the coal bill is settled—had to be inspected at close quarters; but objects at a little distance were quite indiscernible. "On the right," said Mr. Allen, as something big and dark loomed in that direction, "are the gasholders;" and in another place he, pointing to another shadowy structure, remarked "that is one of the old retort-houses." If he had said that those are the pyramids on the right and that is the temple of Solomon over there—well, faith in him was so strong at the time as a guide through the enveloping darkness, that, verily, some of his party would not have questioned his assertions. Into the old retort-house, however, we went, and saw inclined settings that have been working there satisfactorily for four years; and a chimney, built of only 9-inch brickwork, and with continuous crossed bracing from top to bottom, was also an object of interest. That has the reputation of being the cheapest chimney shaft ever erected in Liverpool. There is room in this house for further settings. Will they be inclines or verticals? Time and experience with the latter can really only determine. A visit to the cyanide plant, and an inquiry into points of the process, and the beautiful crystallized product ended the principal features of interest.

Walking, inspection, and fog had done their work in producing a strong desire for tea; and the welcomed and refreshing beverage was quickly served, and as eagerly taken, in one of the men's social club rooms.

THE BUSINESS MEETING.

Directly after tea, a business meeting was held in the recreation room—Mr. W. Prince, the President, occupying the chair.

The President proposed that the minutes of the last two meetings should be taken as read; and, Mr. W. W. Hutchinson (Barnsley) having seconded the motion, this was unanimously agreed to.

The Hon. Secretary (Mr. H. Kendrick, of Stretford) announced the names of some 25 members from whom letters of apology for non-attendance had been received.

A Mournful Duty.

The President said their next duty was a mournful one. It was to record the death of two of their members—Mr. Harrison Veevers and Mr. Marsland. It would, he was sure, be the wish of the members that letters of condolence should be sent to those whom their departed brethren had left behind. He therefore proposed that the Secretary be instructed to convey to the widows in each case the deep sympathy of the members. To approve of this being done, he asked the members to signify by rising in their places.

The members silently rose.

Illness of Members.

The President remarked that two of their number—Mr. J. Timmins, of Wigan, and Mr. J. Wilkinson, of Halifax—were suffering serious illness, which prevented their presence. The members he was sure would wish that their sympathy should be conveyed to these gentlemen.

Approval was at once given to the proposition.

Scrutineers of Balloting Papers.

On the proposition of Mr. Samuel Glover, Mr. J. W. Allin, of Chorley, and Mr. F. Pritchard, of Huyton, were appointed Scrutineers of the balloting papers for office-bearers and new members.

The Manchester Exhibition.

The Hon. Secretary said he had thought it advisable to have on their proceedings a few words relating to the recent exhibition in Manchester; and for that purpose he had drafted the following: "The Gas Exhibition is now an event of the past, and has justified its promotion beyond expectations. It will certainly have a most stimulating effect upon our industry over a very wide area, as, in addition to great numbers of consumers, a very large proportion of gas-works officials and their employees found it advantageous to make repeated visits. The opening ceremony was performed on Oct. 23 by the Lord Mayor of Manchester, assisted by the Mayor of Salford. Mr. Alderman Gibson occupied the chair, and was supported by many prominent people, including Mr. Alderman Phillips, of Salford, the Mayor of Widnes, the President and Council of the Institution of Gas Engineers, officers of many local institutions, the Advisory Committee, and a large number of our own members. The Chairman and members of the Advisory Committee have been most assiduous in their attendance during the run of the Exhibition. The technical lectures were highly successful, and large attendances were the rule. The lecturers were Messrs. Dugald Clerk, R. H. Clayton, and J. W. Graham, Professor T. B. Cohen, and Messrs. J. G. Newbigging, T. Duxbury, J. H. Brearley, S. Meunier, and H. Kendrick. A highly successful course of cookery lectures and demonstrations were given by Mrs. Middleton, who also conducted a cookery competition for school children, which, for various causes, was not well patronized. The Committee have under consideration the issuing of a souvenir, which will probably contain, in addition to a description of the exhibits, a very full report of all the technical lectures. Due notice will be given when this is ready." He added that out of the money received from the Manager of the Exhibition, and taken for dinner tickets, they had a balance in hand of £36.

Reduction of Meetings—Recognition of Junior Associations.

The President said that the members had received a notice regarding alterations of the existing rules. The questions referred to were (1) the qualification of members; (2) the reduction of the meetings from four to three per annum; and (3) the recognition of Junior Gas Associations. These matters would be voted upon at the February meeting; but the object of bringing them forward at this meeting was in order that members might make any observation upon them they might think proper for the consideration of the Committee.

Mr. W. W. Hutchinson (Barnsley) asked whether associate members would be kept on under Rule 1.

The Hon. Secretary replied that the notice only referred to the first clause of Rule 1. It only alluded to the qualification of members, not to associate-members.

The President observed, with regard to the second subject of notice, that it was proposed to drop the August meeting, in view of the poor attendance. It was thought that the August meeting clashed with the annual holidays, and that this and other things prevented a decent attendance. Only eleven members put in an appearance at the last August meeting; and, in consequence, it was considered to be a waste of money and time to continue it. The business meetings would be as hitherto. Respecting the third subject, he might say that, before drafting the rule, the matter was put before the Junior Associations in their district, to see whether the proposed course met with their approval. If carried out, the Institution would have two votes in each of the Junior Associations; and the Junior Associations would together have two votes in the work of the Institution. In his opinion, it was wise the Senior District Institution should keep in touch with the two junior organizations.

The Hon. Secretary said he had communicated with the Secretaries of the two Junior Associations; and both of them, without expressing their opinions on details, had confirmed the principles of the proposition, and were very glad indeed the Institution had made this move. The matter did not originate with the Institution. During the joint meeting of the Junior Gas Associations in Manchester, it was mentioned to several of the members of the Committee, to see whether in this matter they could not bring themselves into line with the Midland Association. The question had been before the Committee, with the result that they had decided to place this proposed new rule before the members.

Mr. S. Glover remarked that the arrangement as to the Junior Associations had his hearty support. As to the reduction of the meetings, he thought the Committee should consider the necessity, with the discontinuance of the August meeting, of moving the November meeting forward a little.

There were no further remarks; and the questions will now come forward at the February meeting in the ordinary manner.

The Fiddes-Aldridge Machines—A Men's Football and Social Club.

According to the *agenda*, the next item was a description by Mr. Allen of the Eccles Street and Linacre Gas-Works of the Liverpool Gaslight Company.

Mr. Allen (who was received with hearty cheers) said that, as every member present had had a printed description of the two works, it would be waste of time on his part to attempt to read it, nor did he think any of the members would wish it. There were, however, two or three observations he should like to make in addition to the printed description of the Eccles Street works. Certain particulars were given as to the working of the Fiddes-Aldridge machine. Most of those present had seen the machine that day; and what he wished to say about it was that, at the present time, they were working four-hour charges, and the weight of the charges was only 5½ cwt.—thus enabling them to carbonize 33 cwt. in 24 hours. What was being done at Eccles Street, however, did not represent what could be done with a new installation. The members were aware that two new machines had been ordered for the Linacre works. Some of them had seen the house in which it was proposed to establish these machines; and in the house there would be thirty beds of sixes, making in all 180 retorts. In this installation, they intended to alter the size and shape of the retorts. Instead of being 22 in. by 16 in., they were going to make them 23 in. by 16 in. The D section would be departed from. The sides would be straight, and rather higher than at present; and the crown of the retort somewhat flatter—the idea being that this would enable a heavier weight of coal to be placed in the retort by the chain. They had no doubt whatever that they could use 8 cwt. charges in the new retorts. No doubt 9 cwt. or even 10 cwt. could be delivered into

each retort; but in estimating 8 cwt., they were quite safe. Mr. J. Braithwaite, of Wrexham, had a beautiful installation of the Fiddes-Aldridge machine.* It represented what might be done on a small works; and Mr. Braithwaite wished him to assure the members of his complete satisfaction with the machine and its results. He had at Wrexham six beds of sixes (five were working at present), 24 in. by 16 in.; and he had put in as much as 10 cwt. charges. At present, however, Mr. Braithwaite was working 8 cwt. charges in six hours; and he was only employing three men per eight-hour shift to do the whole of the work from the delivery of the coal right into the overhead hopper to the discharging of the coke on the bank. He (Mr. Allen) was very interested in the ingenious way in which Mr. Braithwaite was dealing with the requirements of the installation, and must congratulate Wrexham on having such an able Engineer and Manager. He (Mr. Allen) thought that this reference would be interesting to those gentlemen who had small works, and who could not think of putting down a large installation of machinery. He did not think anything else could be said of the machine; and he only wanted to speak of it as he found it. The machine had been developed since it was first put in at the Liverpool Company's Wavertree station; and he did not say that the improvements had come to an end. He saw many engineers before him of greater mechanical skill than he possessed who would improve and make the machine better than it was at present. With respect to Linacre, he only wished, in addition, to refer to the social work Mr. M'Ewen was doing among his men. They recognized, as managers, that their work should not be confined entirely to mechanical arrangements on the works. A most important factor on any works were the men who were employed; and if one could interest them in their employment, and make the conditions better for them, even if purely from a selfish motive, it should be done. Mr. M'Ewen had been able among his men to organize what was called a football and social club. The formation of this was quite recent and was much appreciated by the employees. The pitch was on the works; and two teams had been playing regularly since the beginning of the season. The Presidentship was held by himself (Mr. Allen); he being an old player and supporter of football in the Liverpool district. The social club was presided over by Mr. M'Ewen. The club room was open to all members, when off duty, between the hours of 6.30 to 10 p.m. each day. Social evenings were held at intervals; and as there was considerable musical and other talent among the men, the entertainments were much enjoyed. Therefore, besides improving the manufacturing machinery, they were endeavouring to make the lot of the men as pleasant as possible, and trying to make them feel that the Company and officers were interested in them as men, and in the work they were doing for the Company.

The Woodall-Duckham Vertical Retort System.

Mr. Duckham was called upon by the President to make a few remarks on the Woodall-Duckham vertical retorts. His statement appears on p. 708, together with the succeeding observations made by members.

New Officers and Members.

The Hon. Secretary announced the result of the ballot as follows:—

President: Mr. T. Duxbury, of Oldham.

Vice-Presidents: Mr. J. Wilkinson, of Halifax; and Mr. H. Kendrick, of Stretford.

Hon. Treasurer: Mr. T. Newbigging, of Manchester.

Hon. Secretary: Mr. W. Whatmough, of Heywood.

Committee: Mr. E. Allen, of Liverpool; Mr. J. Furniss, of Slaithwaite; Mr. S. Glover, of St. Helens; Mr. W. Smith, of Bolton.

Auditors: Mr. C. Elliot, of Leyland; Mr. W. L. Donaldson, of Lymm.

New Members: Mr. J. E. Dudley, of Higginshaw, Oldham; Mr. W. A. Halsted, of Northallerton; Mr. J. R. Hill, of Bradford Road, Manchester; Mr. J. C. Moon, of Middleton; Mr. T. Ousey, of Bloom Street, Salford; Mr. H. Shaw, of Regent Road, Salford; Mr. H. Talbot, of Todmorden; Mr. James Taylor, of Hollinwood, Oldham; Mr. Geo. Haynes, of Caryl Street, Liverpool.

Associate-Member: Mr. R. H. Garlick, of Salford.

Votes of Thanks.

The President moved a hearty vote of thanks to the Chairman and Directors of the Liverpool United Gas Company. The members, he remarked, appreciated deeply the kindness of the Company in allowing them the privilege of going over their large and important works. They much regretted, with Mr. Allen, that the weather had not been favourable—so much having been obscured—for a good insight into the works. But they had had enough to interest and charm the members. It was unnecessary to say that the kindness of the Directors had not only given them a pleasurable day, but much that was highly instructive. It was only large undertakings like that at Liverpool that could afford to experiment in costly new methods, and, by their experience, profit the small undertakings.

Mr. R. Watson (Doncaster), in seconding, observed that the members had all been greatly interested by their visit, and, in spite of the fog, would not have missed what they had seen that day.

The motion was carried with applause.

Mr. S. Glover said the honour had fallen to him of expressing the thanks of the members to Mr. Allen for his kindness that day, and to his assistants for so cordially backing up their chief. He could assure the members that they had missed a good deal in not having seen the great extent of the concern over which Mr. Allen ruled as chief officer so wisely and well. Mr. Allen read his duty to the public and to his Company as a large and responsible one; and he fulfilled that duty in every possible way.

Mr. J. G. Newbigging seconded the motion; remarking that he did not the think members could have gone to any single undertaking in the country where they could see so many methods of carbonizing, which showed that Mr. Allen, in his charge of the Liverpool Gas Company's works, intended to be progressive. He thought, too, he deserved great credit for selling 20-candle gas for 2s. 6d. per 1000 cubic feet, and paying maximum dividends. He did not know what he would do when the illuminating power was reduced, which no doubt would be done shortly.

The motion was carried by acclamation.

Mr. Allen, in reply, said he had no difficulty in replying to the first vote on behalf of the Chairman and Directors. The Chairman took a great interest in the business—not because it was the Company's business, but because he was a man who believed in doing everything thoroughly. Both the Chairman and the Directors very willingly acceded to the request he (Mr. Allen) made in regard to the visit of the members; and he was desired by the Chairman to express his great regret that he was unable to preside at the luncheon (as he had intended to do) owing to slight indisposition. Had he been with the members, they would have been glad to see him; and he (Mr. Allen) hoped the members would take from him the spirit in which it was sent this message of regret from his Chairman. With regard to the second vote of thanks, he appreciated very much the kindness of Mr. Glover and Mr. Newbigging, and the hearty manner in which the members had received the vote. He was personally indebted to Mr. Gibson, Mr. M'Ewen, and all those of his staff who had assisted him that day.

The President-Elect.

Moved by Mr. J. Booth, and seconded by Mr. T. Duxbury, the Scrutineers were thanked for their services. Mr. Duxbury took the opportunity of thanking the members for having placed him in the honourable position of President. His Committee hoped the Institution would pay a visit to Oldham during his year of office; and on that occasion they would be pleased to entertain them.

The members lost no time to making their way to Marsh Lane station; and thence by electric train to Liverpool. From there, as far as belated and fog-bound trains allowed them, they returned to their homes—not one, we are sure, regretting that the unfavourable atmospherical conditions had not induced them to stay at home.

INVERTED BURNERS FOR STREET LIGHTING.

At the Meeting of the Brandenburg Association of Gas Engineers, which was held in Berlin last spring, a paper was read by Herr Winkler, of Berlin, describing the methods employed in the construction and utilization of inverted incandescent gas-burners for the illumination of streets. In the course of his paper, Herr Winkler went over much ground already covered by numerous writers; he also developed various points of interest in connection with the application of inverted burners, which, from the account of his communication published in the "Journal für Gasbeleuchtung," may be summarized as follows.

A well-designed inverted burner exhibits its maximum emissive power at an angle of about 45 degrees below the horizontal, the light falling off but little at lower angles still. Hence ordinary concave reflectors which are used for street-lamps containing upturned burners are not suitable for employment with inverted burners. Even a convex reflector, placed above the mantles, as shown fig. 1, is not the best that can be adopted, inasmuch

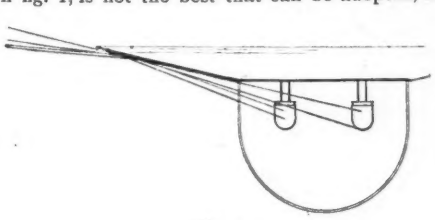


Fig. 1.

as many of the rays are not diverted by it into the required direction. A better form of reflector is shown in fig. 2, where the

* The machine at Wrexham is illustrated on p. 699.

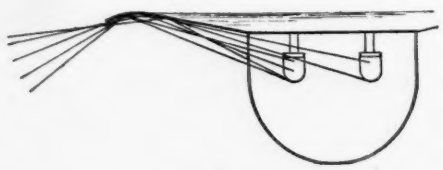


Fig. 2.

portion nearest the lantern is convex, the next part is horizontal, and the outer margin is concave and points downwards a little. Again, as the maximum emissive power of an inverted burner lies at angles of about 45 degrees with the horizontal, it follows that the best illumination is received on a surface as far away from the base of the standard carrying the lamp as the light is above the ground level. Since, however, the supposititious surface upon which the light is to fall in the case of street-lamps is 3 feet above the ground, the height of the lights must be calculated in accordance with the formula $a + 3$ feet, where a is the distance at which the maximum illumination is to be received. This formula leads to the construction of very high standards for the lamps; and it therefore becomes necessary to have some device for raising and lowering the burners, in order that they may be cleaned and adjusted properly. If the burners run at ordinary low pressure, the gas connection may, of course, be made by means of flexible metallic tubing issuing from a point half-way up the standard. If, however, intensified lighting is employed, the connection to the lamp should be composed of rigid members working on elbow-joints about a connection higher than half-way up the standard. But whichever system is employed, care must be taken to provide a safe trap for any liquid that may condense from the gas; the supply pipe, for example, being led from the ground to a point much above the spot where the flexible or other connection starts, then bent down again, and bent up a second time. It should be remembered that the maintenance of inverted burners is somewhat more complicated than that of upturned ones; the former not only require cleaning and fresh mantles, but also need to have the gas consumption carefully regulated and to be otherwise adjusted while alight.

As heat evolved on the combustion of the gas is communicated more readily to the metallic portions of an inverted burner than to the corresponding parts of an upturned burner, the inverted burner becomes hotter than its older rival when alight, and the heat so absorbed is freely communicated to the gas and air. The rise in temperature of the gas causes it to increase in volume and decrease in specific gravity; but whereas this change aids in the passage of the gas from the nipple to the place of combustion in an upturned burner, it retards the motion of the gas in an inverted burner. For the reasons given, too, the effect is proportionately more marked in the inverted burner; so that the green inner zone which marks the hottest portion of the gas-flame is more apt to be destroyed in a hot inverted burner than in a hot upturned one. As the inverted burner is obviously cold when first lighted, and must light without difficulty, while it soon becomes hot and must continue to burn perfectly, the burner must be so designed that the gas does not inject too much air when the burner is cold, nor inject too little when it is hot. Furthermore, although the earlier part of the mixing-tube of an inverted burner may be given the same relative dimensions as that of an upturned burner—*i.e.*, 75 times the diameter of the jet—the gradual increase in temperature of the mixture of gas and primary air on its way to the orifice suggests that the mixing-tube be made conical in shape with a conicity proportioned to the increase in volume. A burner provided with a parallel mixing-tube is usually easily affected by noise. One method of neutralizing the disturbing effect introduced by the gradual rise in temperature of an inverted burner when it is lighted, is to place wire gauze within the mixing-tube. As the resistance offered by a perforated obstacle to the passage of a gas is proportional to its specific gravity, the gauze so employed allows the gas and primary air to pass through its meshes more readily when hot than when cold.

Some measurements made by Herr Winkler upon burners constructed by the German Gasglühlicht Aktien Gesellschaft show that the consumption of air in an inverted burner is less than that in an ordinary upturned Welsbach; while, in the former burner, the consumption, of course, varies until the burner has reached its maximum temperature. At the moment of lighting, an inverted burner consumes about 3·5 parts of air by volume to 1 part of gas. During the first five minutes that it is alight, it consumes, on an average, 2·04 parts of air to 1 part of gas; eight minutes after being lighted, it consumes only 1·9 parts of air; and twenty-five minutes after being lighted, it consumes only 1·65 parts of air for every 1 part of gas.

A point of very considerable importance in the successful exploitation of inverted burners for street lighting is the method adopted for lighting them. The plan of lighting from outside by means of a torch is not satisfactory even in the case of upturned burners, and is still less so in that of an inverted. Hence the best method to employ is a pilot flame. But, unfortunately, the consumption of the bye-pass burner is too large to be altogether ignored. The consumption of a bye-pass fitted to an ordinary upturned incandescent burner is about 4 per cent. of the normal consumption of the burner itself, whereas the consumption of the pilot flame fitted to an inverted burner is 5½ per cent. Moreover, the pilot flames of upturned burners are usually so arranged that they are almost extinguished whenever the main burner is alight.

The consumption of gas in a pilot becomes much more considerable in the case of multiple lighting units; for hitherto it has been necessary to have as many pilot-flames as there are burners and mantles in the unit. Therefore the plan now occasionally adopted of using only temporary pilots, or of employing one centrally disposed pilot which yields, by suitable manipulation of the cock on the bye-pass supply, as many tongues of flame at the moment of lighting as there are individual burners in the lamp, has much to recommend it. According to the former system, the bye-pass supply leads down to a small chamber disposed in a convenient situation between the individual burners. The chamber then communicates through a lateral passage with the exterior of the lamp. When the cock on the bye-pass supply is opened and the torch is applied to the exterior orifice of this side tube, the flame of the torch ignites the gas in the central chamber, and tongues of flame issue to the different mantles until the gas in each large burner is, in its turn, ignited.

In the other plan, the bye-pass supply communicates, as before, to a spherical or hemispherical perforated chamber arranged concentrically above or below the ring of incandescents composing the multiple lighting unit. The chamber is perforated underneath, from which opening gas escapes so as to yield a permanent pilot flame. Owing to the shape of the chamber and the adhesion between the metal of which it is constructed and the gas-flame, the latter is reasonably stable, and will withstand a considerable amount of wind. But when the main cock on the lighting unit is opened, an additional supply of gas passes down the pilot-tube, and the small burner momentarily increases into tongues of flame, each pointing towards one of the main burners, which are thereby lighted in the usual fashion. It is very desirable that the pipe supplying gas to the pilot shall be protected from the products of combustion and the heat of the main burners, lest the metal be quickly corroded. With this purpose in view, the pilot supply pipe is advantageously brought down through the casing of the lamp within the air-chamber and only allowed to penetrate into the portion of the casing which acts as a chimney for the products at the last possible moment.

Most multiple units are so designed that some of them can be extinguished at midnight or at any desired hour, leaving one or more alight until the morning. This method of construction is perfectly applicable to inverted burners; the main cock, with its levers, being so arranged that at midnight the lever is drawn down against a stop, extinguishing some burners and leaving others alight. A further pull on the lever by means of the hook on the lamplighter's torch then extinguishes every burner in the morning. It is necessary that care should be exercised in constructing the cock on an inverted burner, and in choosing the place for it, lest the grease applied to the plug disappears by liquefaction or evaporation. On this ground the cock is advantageously placed below the spot at which the combustion products escape from the lantern. For example, in one burner the gas-supply pipe leading to the top of the casing branches stirrup-fashion, and the cock is placed at the base of the stirrup, from which spot the bye-pass pipe leads directly downwards. Inverted burners are better fitted up with wrought-iron pipes than with cast iron, for the resilience of the former protects the mantles more efficiently from the vibrations set up by traffic. When properly arranged, inverted burners require only two to three mantles each year.

An important requirement in the case of inverted burners is that they shall be supplied with cold primary and hot secondary air. When constructed in this manner, and when the gas-supply pipe is kept thoroughly cold, the burners become regenerative or recuperative, and a better duty is attained. The velocity of the secondary air, however, must be such that the flame does not get distorted.

Another New Fuel.

Telegraphing under this heading last Thursday, the correspondent of the "Tribune" at Dunkirk, says: "A new fuel, which it is confidently believed may play a great part in the heating problem, has been invented by Major Colas, commandant of the Dunkirk Fire Brigade, who has taken out a patent for his invention, under the name of "Charbonette." The fuel is made of inexpensive materials, at a cost which is stated not to exceed two-thirds the cost of coal. It lights easily, and, becoming incandescent, gives out no smoke, but intense heat, and consumes itself entirely, leaving no trace of ash. It has the appearance of blocks of cork; another advantage being that it leaves no mark when being handled, and it also has no smell. The new fuel has been tried in the presence of a number of prominent residents, who have signed a report setting forth the above results. It is intended to establish a factory at Dunkirk capable of producing 40,000 tons annually of this new fuel."

According to a telegram in "The Times" a few days ago, the next Nobel Prize for Chemistry will probably be awarded to Sir William Crookes.

TWO WORKS OF THE LIVERPOOL GAS COMPANY.

In view of the visit of the Manchester Institution to the works of the Liverpool United Gaslight Company on Saturday, an interesting *souvenir*, in the form of a pamphlet containing an illustrated description of the Eccles Street and Linacre works, had been prepared by Mr. E. Allen, the Engineer of the Company. Most of the particulars in regard to the former works were given (accompanied by a plan) in the "JOURNAL" for the 14th of May last, in connection with the visit of the members of the Manchester and Yorkshire Junior Gas Associations on the previous Saturday; but, as several changes have since been made, it will not be out of place to reproduce some of them here in conjunction with those relating to the Linacre works.

Eccles Street Works.

These works were erected by the original Gas Company, whose operations were commenced on a site at Dale Street in 1818. Doubtless the advantage of being adjacent to the canal was appreciated, and also the opportunity of laying out works on a larger scale than was possible at Dale Street.

The two retort-houses, forming one building, remain as they were originally erected. The total capacity of the three benches of retorts will be 2¼ million cubic feet per day. The condensers are of the vertical pipe type, consisting of 72 cast-iron pipes, 12 inches diameter and 29 feet high, standing in four rows. There are three cast-iron cylindrical scrubbers, 9 feet diameter and 16 feet high, fitted with plates and boards. Under the scrubbers and condensers are cisterns to hold tar and liquor.

There are two sets of exhausters, designed by the late Mr. Alfred King, which are now probably unique. Each set consists of three bells, working in a chamber containing sufficient water to form a seal, and covering the inlet-pipe; the whole being enclosed in a gas-tight casing. A balanced flap-valve is fixed on the top of the inlet-pipe, and another in the top of the bell; so that when the latter is alternately raised and depressed by a connecting-rod attached to the crank of a revolving shaft, the action is as follows: On the up-stroke, gas is sucked out of the inlet-pipe into the bell, and by the same movement gas is expelled from the casing. On the down-stroke, gas is expelled from the bell into the casing. The upper (outlet) portions of the three casings are all connected; and as the three bells are set to move a little while behind each other, discharge of gas is uninterrupted and tolerably constant in amount.

In addition to the tower scrubbers, there is a "Standard" washer-scrubber of 2 million feet per day capacity, and one of Messrs. C. & W. Walker's carbonic acid washers arranged as a naphthalene washer by having a layer of carburetted water gas tar-oil floating on the top of the water. This device of washing for naphthalene has brought down its amount from about 13 to 6 grains per 100 cubic feet; and this has reduced the stopped street-lamps from between 2000 and 3000 to from 20 to 30.

The purifiers were formerly four water-lute boxes; but these have recently been replaced by four boxes, each 30 ft. by 23 ft. by 5 ft. 6 in. deep, fitted with Green's lids and Milbourne's patent fasteners. A gravity bucket conveyor is being used for handling the material, and is driven by a 4 B.H.P. electric motor.

There is only one gasholder, of two lifts, and 923,800 cubic feet capacity, which replaced the six original ones. There are two station meters. Governors control six districts; and their requirements are such as to need a large supplementary supply of gas from the Linacre works. The photometer-room and laboratory are situated above the stores.

The well-pump and mortar-mill are worked by a beam-engine, which, though very ancient, continues to render excellent service. These works are remarkable for the association of ancient and modern machinery.

There are at Eccles Street two retort-houses, forming one building; and in one of them there has been a bench that occupied one-half of the house, containing eight beds of sixes on Gibbons's regenerative system. The other half was used as a store for fire-brick goods, &c. The adjoining house had been fully occupied by four benches of direct-fired retorts, which were only at work during midwinter, and had come to the end of useful life. The old benches were cleared out early in 1905; but the chimney, which was in the centre of the house and in good condition, was left standing. Two benches of eight beds of sixes, with regenerator settings, have been built in the house. They are placed out of centre, so as to allow ample space for the Fiddes-Aldridge machine on one side, while sufficient room was left for handling the discharged coke and attending to the producers on the other. Ascension pipes and hydraulic main were provided on the discharging side only.

Coal and cannel are brought in barges on the Leeds and Liverpool Canal. The material is taken out of the boats by a grab suspended from a jib-crane, and delivered into elevated hoppers, passing on its way through an Ingrey patent automatic weighing and recording machine. For the hand-charged retorts, the coal is drawn off by bottom doors, but for the new benches it is guided by a shoot into a breaker, whence it is elevated and conveyed direct into the overhead hoppers, from which the Fiddes-Aldridge machine takes its supply.

Since October, 1906, one bench has been constantly at work, and has given great satisfaction. The cost of carbonizing has been reduced considerably below that at the Wavertree works (where the machine was on trial for twelve months before its installation at Eccles Street), in consequence of more favourable conditions. The weight and duration of the charges have been varied, with, of course, a variation in the cost. The maximum weight of the charge was 8 cwt., and its duration was six hours. The coal used was finely broken, without admixture of cannel; but as the measuring chamber on the machine was limited to 7¼ cwt., it was not convenient to continue this method of working.

Better results, however, were obtained from four-hour charges of 6 cwt., all coal—thus enabling each retort to carbonize 36 cwt. per day, or 86 tons 8 cwt. by the bench, at a cost of 11·4d. per ton. This includes all wages paid to the three machine-men, one power-house man, three lidmen, six coke-wheelers, three furnace-men, and one hopper-man. These men deal entirely with the operations from the coal-shoot to the coke-bank. At that time the bench in the other house carbonized all cannel. But when it was dropped and cannel had to be mixed with coal in the machine, it was found necessary to reduce the charge to 5½ cwt. and 4 hours 48 minutes (or five charges per day); the cost being nearly 15d. per ton.

As far as the great majority of gas-works are concerned, the use of cannel need not be considered; and, therefore, for an installation of 48 retorts, 11·4d. may be taken as the cost of wages per ton under the above conditions. The figure could, however, be further reduced if the power-house man were dispensed with, or if two instead of three shifts of men were employed. Again, it may be possible to carbonize a heavier charge of fine coal—say, 8 cwt.—and thus reduce the cost per ton.

So far, one bench only has been dealt with; but when the new bench is brought fully into commission, better results will be obtained. Thus, with the two benches at work on the basis of four-hour charges of 6 cwt. each, and employing three machine-men, one power-house man, three lidmen, twelve coke-wheelers, six furnace-men, and two hopper-men, the cost would work out at 9d. per ton.

The portion of the Fiddes-Aldridge machine which is responsible for the charging and discharging of the retorts simultaneously consists of a series of parallel plates held in a vertical position by means of flat-iron stays—curved or arched to suit the crown of the retort, and firmly secured at each end to the plates. These plates are joined to each other by a kind of hinged joint—thus forming a "chain," as it is called, which can be wound on a large vertical wheel. At intervals along the length of the chain, push-plates are suspended from the arched stays previously mentioned. They are free to lift in one direction, but cannot go beyond the vertical position when the chain is entering the retort—being prevented from so doing by projections on the side plates.

It will be readily seen that these push-plates will push the coal along the floor of the retort in the forward direction, but when reversed will automatically lift and pass over the top of the coal, thus helping to spread it evenly in the retort. The construction of the "chain" differs in a few important particulars from the "chain" used in the Wavertree machine.* The side plates are deeper, and the push-plates are hung from the highest possible point—*i.e.*, an arched stay—thus enabling a much heavier charge to be dealt with than formerly. In the Wavertree machine, the amount of the charge was limited by the height of the bolts on which the push-plates were pivoted. The front push-plate is larger and heavier than the other push-plates, and is used for pushing the coke from the retort. In other respects, its action is similar to the others.

The front links or side plates immediately behind the front push-plate have been improved, and now have the effect of spreading the charge evenly up to the sides of the retort. This is brought about by means of a small "wing" or "plough" and an opening at each side; so that as the chain is being withdrawn from the retort, the two ploughs throw some of the coal, through the openings in the chain, against the sides of the retort. Before this improvement of the machine was introduced, the charge of coal was not laid right up to the sides of the retort—a space of an inch or so being left. The chain and the large wheel on which it is wound are the essential parts of the machine. The other portions are for the purpose of feeding the coal and moving the machine to suit the various positions of the retorts.

The outer frame is mounted on four travelling wheels, and carries six lifting pulleys (four at the back and two at the front), from which is suspended the inner frame of the machine. The outer frame also carries part of the travelling gear, the measuring chamber, the shoot, and the gear for operating the overhead hopper doors. The latter is a new arrangement, whereby the exact amount of coal required for one charge is taken automatically by the machine while it is travelling from one retort to the next, without any special attention on the part of the driver. Means are provided for rendering this gear inoperative when it is desired to pass along the floor of the house without taking any charges. The measuring chamber is provided with a hinged plate inside to reduce the capacity; so that the charge may be adjusted and fixed to any amount between 5 and 7¼ cwt. A sliding door is fixed at the base of the measuring chamber which is operated by the driver by means of a chain and chain-wheel.

The front portion of the outer frame of the machine has been brought farther away from the bench than in previous installations, giving more room for the lidmen to open the mouthpiece

* This machine was described in a paper read by Mr. Allen before the Institution of Gas Engineers at their meeting in 1906. (See "JOURNAL" for June 26, 1906, p. 900.) An illustration of the last machine erected—that at Wrexham—appears on p. 699 of to-day's issue.

lids, and enabling the driver to obtain a better view of the chain entering the retort. This improvement also has considerably reduced the weight of the machine, and has rendered its appearance lighter.

The inner frame is suspended inside the outer frame by four steel ropes, and is capable of being raised or lowered to the different levels of the retorts. It carries the chain, the chain-wheel, the guides, the apron plate, and the lower portion of the telescopic shoot on the one side; while the driver's platform, the motor and controller, and the gear for the charging, lifting, and travelling motions are on the other side. An improvement has been made in the driver's platform, which in this case extends outside the outer frame of the machine—a gap in the outer frame being formed so that the operator may step on to the platform and enter the machine at any level. In the Wavertree machine the driver was enclosed inside the outer frame, which was very inconvenient. The telescopic shoot has also been improved, and now delivers the coal directly in the centre of the chain; adjusting plates being fixed inside, near the mouth, to regulate the flow of the coal.

The machine is driven by means of a Siemens enclosed type motor, 13½ B.H.P. at 220 volts and 480 revolutions per minute. It is fitted with a solenoid brake, and is worked by a tramway type controller. The current is obtained from overhead wires by means of collectors which are fixed to the outer frame of the machine and conveyed to the motor by a flexible cable. The power of the motor is transmitted by means of a worm and worm-wheel to a vertical shaft, and thence (1) by bevel and spur wheels to the chain wheel for the charging and discharging, (2) by spur and worm wheels to a shaft on which four barrels are keyed for winding the steel lifting ropes, (3) by spur, worm, and mitre wheels to the two shafts on which the travelling wheels are keyed. These three motions are each fitted with a sliding claw clutch, thrown in or out of gear by means of a lever near the driver's platform. Thus the driver on the platform has control over all the operations of feeding, charging, discharging, lifting, lowering, and travelling.

All the gear wheels and the travelling wheels are made of cast steel, with the exception of the worm wheels, which are made of phosphor-bronze. The large spur wheel which is fixed up to the chain wheel has in this case been made in a number of segments, easy to replace should breakage occur.

The machine runs on a pair of tramrails laid on a solid concrete foundation. In planning the installation it was arranged that the cellar on the charging side of the bench should be only 6 feet in width (sufficient for access to the dampers), in order that the tramrails might have a foundation on the solid ground. At Wavertree the rails were laid on a "concrete with expanded metal" floor, which spanned the cellar; but this was found so unsatisfactory that a wall has been built to carry one rail, and the floor under the other has been greatly stiffened.

The whole of the coal-handling machinery is driven electrically in a similar way to that at the Wavertree works. The electrical plant was supplied by the Electric Construction Company, and the National Gas-Engine Company provided a 50 B.H.P. gas-engine. Recently this plant has been duplicated. Electric current is also used for driving a gravity bucket conveyor in the purifying-house and for lighting that building.

Linacre Works.

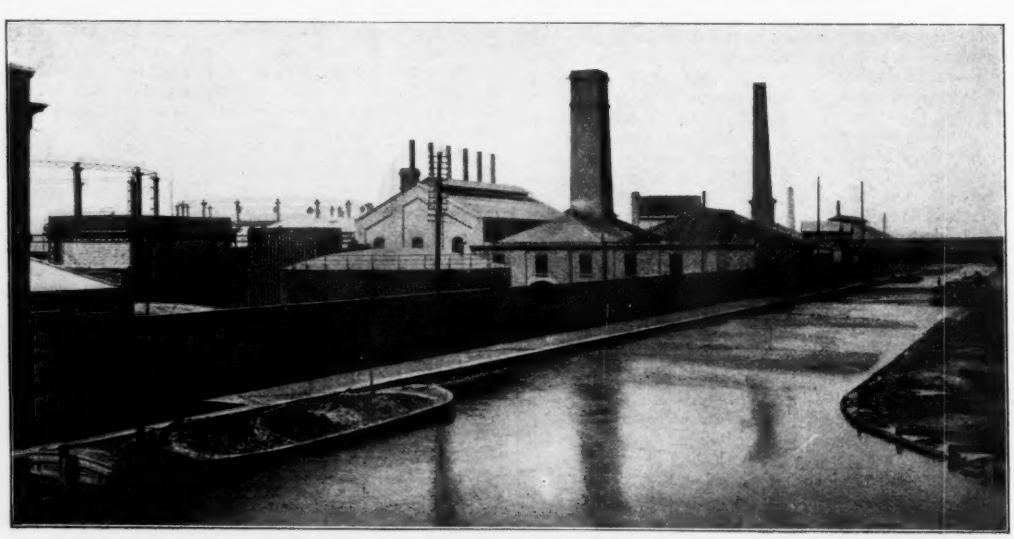
These works were opened in 1867, and were built to meet the rapidly increasing demands made upon the Company. They are situated in the borough of Bootle, on the banks of the Leeds and Liverpool Canal, by which there is a direct connection to the Wigan coalfield. An overhead railway siding enables coal also to be obtained from Yorkshire and the Midlands by the Midland Railway Company.

The area now covered with buildings and plant occupies nearly 25 acres of land. The first section, having a daily make of 1½ million cubic feet of gas, was followed in 1872 by another, with a capacity of fully 3 millions; and in 1873 an additional plot of ground was obtained on which plant for 5 million cubic feet per day was subsequently erected. The success of the carburetted water-gas process at Garston led in 1897 to the erection of a plant at Linacre, which was accommodated in the oldest retort-house and coke yard. By this alteration, an output of 1½ million feet was replaced by 4½ millions per day; and provision is made for duplicating the plant when the need arises.

Retort-Houses.—In the north section, there are three retort-houses forming one building. In one there are 14 beds of sixes, hand charged and drawn; in the other two are 26 beds of sixes, charged and drawn by Arrol-Foulis machines, with the necessary coal breaking and handling plant. In the south section, are two retort-houses. No. 1 house has a bench of inclines—eight beds of eights—with the usual coal-handling plant. Coal is taken from the canal barges by a jib crane and grab, and delivered to an Ingrey patent automatic weighing-machine, from which it passes through a breaker to a twin elevator, and thus is conveyed to hoppers in the roof of the retort-house. Some old retort-beds occupy the other half of the building, but will make way for modern plant in the near future. Coal-stores, on each side, run the length of the building. No. 2 house is fitted with horizontal retorts, which are operated by four pairs of Arrol-Foulis machines, with the necessary coal breaking and handling plant. It may be remarked that arrangements are being made to replace this machinery with a modern installation, comprising two of the Fiddes-Aldridge simultaneous charging and discharging machines, continuous overhead hoppers having a capacity equal to two days' supply, and coal-handling plant, consisting of two travelling jib cranes and grabs, for discharging the canal barges; also weighing-machine, breaker, elevators, conveyors, and electrical plant. The cranes will run on an overhead railway extending along the yard used for stocking coal in the one direction, and along the coke yard in the other direction, so that they may be used for the purpose of putting coal into stock or loading barges with coke.

Condensers, Washers, &c.—In the north section, there are eight parallel sets of condensers, 31 feet high, each consisting of 44 cast-iron pipes, 12 inches diameter, arranged vertically, with cast-iron connecting-boxes at the top and bottom. There are six scrubbers, 8 feet square and 24 feet high, arranged in two parallel sets of three each. There are two "Standard" washer-scrubbers, each having a capacity of 3 million cubic feet per day. In the south section, there are eight parallel sets of 12-inch vertical cast-iron pipe condensers, 30 feet high, each consisting of 56 pipes and cast-iron connecting-boxes at the top and bottom. There are three Livesey washers—two of them having a capacity of 2 million cubic feet and the other of 3 millions per day. There are also three "Standard" washer-scrubbers—two having a capacity of 2 millions and the other of 3 millions per day; the latter being fitted with Holmes's brushes and used for the extraction of cyanide from the gas.

Purifiers.—In the north section there are six purifiers, 52 ft. by 26 ft., for treating carburetted water gas; also two boxes 58 ft. by 27 ft., and two boxes 43 ft. by 34 ft., for coal gas. They are provided with a system of water-sealed valves, and shoots for discharging the boxes on to the floor below. The material used is lime throughout. In the main building in the south section there are eight purifiers, each 36 ft. by 23 ft. They are provided with water-sealed valves, and shoots for discharging the material on to the floor below. The boxes are fitted with Spencer's hurdle grids; but these are covered by a deep layer of oxide above them, in order that sufficient time-contact may be ensured. There are also two check boxes, each 39 ft. by 25 ft., in a covered yard. The material used is bog ore.



Leeds and Liverpool Canal, Linacre Works.

Exhausting Machinery.—There are in the north section three two-blade exhausters, by the Bryan Donkin Company, each with a separate engine, and having a capacity of 200,000 cubic feet per hour. These exhausters are placed between the scrubbers and the washer-scrubbers. In the south section, there are three of Beale's exhausters, by Messrs. W. H. Allen and Co., two of them having a capacity of 100,000 cubic feet, and the third of 150,000 cubic feet per hour. A separate engine is provided for each exhauster.

Distributing Exhausters.—A portion of the gas manufactured at the Linacre works is pumped to some of the other town stations for distribution. For this purpose, four pairs of exhausters, each having a capacity of 65,000 cubic feet per hour, are employed—each pair being driven by one engine. The makers of these exhausters are Messrs. Gwynne and Co.

Station Meters.—Nos. 1 and 2, in the north section, are each of a capacity of 45,000 cubic feet per hour. Nos. 3 and 4 are of 60,000 cubic feet capacity each. No. 7, for carburetted water-gas, has a capacity of 175,000 cubic feet per hour. Nos. 5 and 6, in the south section, are each of a capacity of 125,000 cubic feet per hour. The meters were all made by the Gas-Meter Company, of Oldham.

Gasholders.—The particulars of the various gasholders are embodied in the following table:—

—	Diameter. Feet.	Lifts.	Depth. Feet.	Capacity. Cubic Feet
No. 1	140	2	60	859,000
,, 2	140	2	60	859,000
,, 3	152	2	60	1,007,000
,, 4	140	2	60	859,000
,, 5	163	2	60	1,176,000
,, 6	163	3	90	1,739,000
,, 7	178	2	60	1,420,000
,, 8	178	2	60	1,413,000

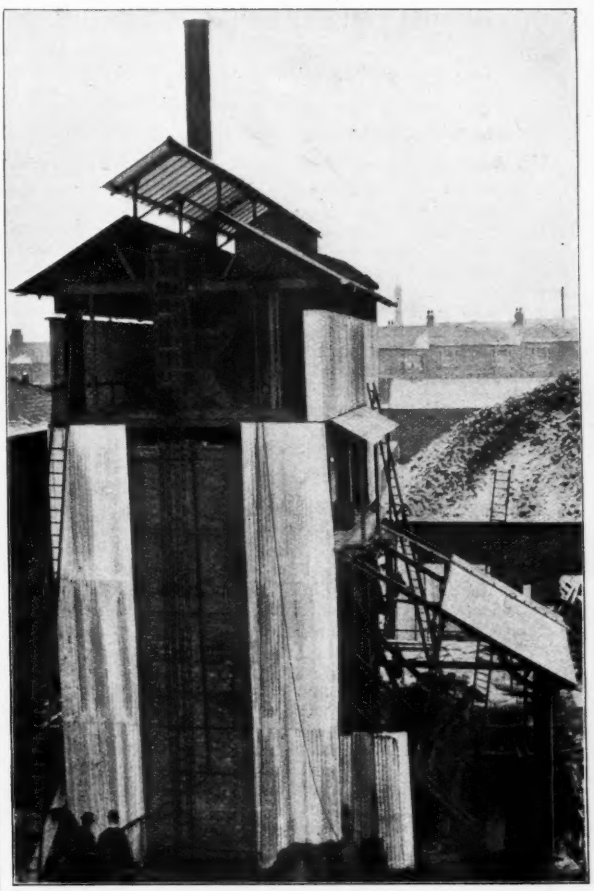
Governors.—Five governors with bye-passes are accommodated in a building that adjoins the north entrance gate, and one was subsequently erected at the south-east corner of the gasholder yard.

Carburetted Water Gas.—This plant was supplied and erected by Messrs. Humphreys and Glasgow, in 1897. There are four sets of a capacity of one million feet and two of half-a-million cubic feet per day. One of the latter has been utilized for the methane-hydrogen process, of which a description is given elsewhere. Three boilers (Babcock-Wilcox) raise an ample supply of steam for all purposes. The machinery comprises blowers, gas-exhausters, pumps, &c.; and these are capable of also dealing with an additional installation of producers. Coke is raised to the firing floor by means of a hydraulic hoist. The scrubbing and condensing plant is situated outside the building, and two settling-tanks deal with the foul water. The gas is purified with oxide of iron and lime, and after passing through a station meter is uniformly mixed with the coal gas. Oil is received by rail, road, and canal, and is stored in a tank of 1700 tons capacity.

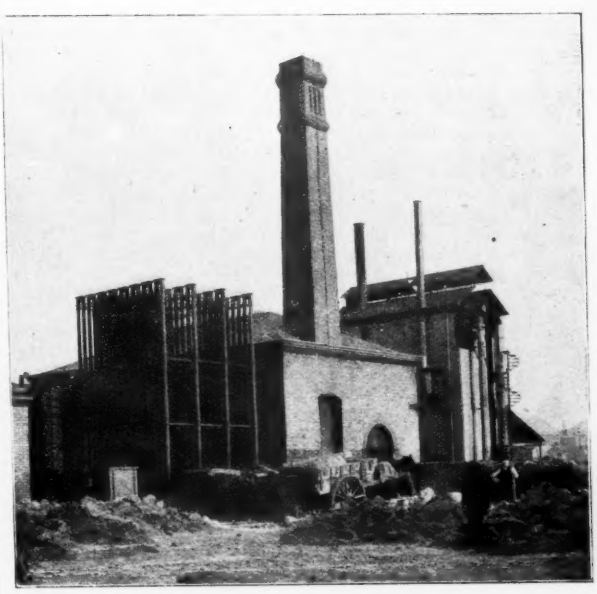
Cyanide Process.—The process is that patented by Messrs. Davies and Neill, and known by their names. The cyanides in the gas are, as far as practicable, extracted by the action of a solution of soda and ferrous carbonate in a "Standard" washer. The resultant liquor is passed through a still, so that any ammonia in it may be driven off by means of wet steam. This is condensed and run into liquor wells. The cyanide liquor is passed through a filter-press, to separate insoluble matter. The clear solution and washings from the filter-press are concentrated by dry steam in a Kestner evaporator, and run into vats to crystallize. The crude crystals (sodium ferrocyanide or prussiate of soda) are washed with mother liquor to remove the soda and insoluble matter, then re-dissolved in a small quantity of hot water. Any insoluble matter is allowed to settle, and the clear liquor run into crystallizing vats, where the prussiate of soda slowly forms saleable crystals on pieces of rope suspended in the liquor.

The plant is accommodated in a two-storey building, and is capable of dealing with gas from 500 tons of coal per day. The mixture for use in the washer is prepared in special vessels, and the precipitated ferrous carbonate is separated from the sodium sulphate solution by filter-presses, and then mixed with soda and water. Steam is raised by a Cochrane boiler situated outside the building, or is taken from adjoining boilers. The process has been in operation since April, 1905, when an arrangement was made for the patentees to work it and to pay so much for each ton of coal used in the manufacture of the gas treated for cyanide; but since November, 1906, the plant has been the Gas Company's property and under their control. The financial results are stated to have been very satisfactory; and no inconvenience or nuisance has been caused by the operations.

Woodall-Duckham Vertical Retorts.—An installation of two beds of vertical retorts, each containing four retorts, is erected outside the retort-house of the experimental works. Each retort is 25 ft. long, and tapers from 30 in. by 22 in. at the bottom to 24 in. by 10 in. at the top. There are two producers; and the settings are of the regenerator type. Coal is elevated from the ground and delivered into four hoppers, each of which supplies two retorts through a feed-roll arrangement. Gas is taken off from the mouthpieces by two foul mains. There are openings in the lids for inspection and pricking. The coke is regularly removed from the bottom of the charge by a reciprocating pusher, and drops on to an ingenious push-plate conveyor, which passes through a water-seal and delivers the coke into barrows. The machinery is driven by an old vertical steam-engine. This installation was joined on to an experimental plant fully provided with condensers, Livesey washers, exhauster, purifiers, meter, gasholder, and photometer-room. The arrangements are such as to enable definite results to be obtained. It may be stated that each retort is expected to carbonize 3 tons of coal per day.



Vertical Retorts, North Works, Linacre.



Experimental Works and Vertical Retorts, North Works, Linacre.

The late Mr. J. S. Marsland, a Managing-Director of Drakes Limited, whose painfully sudden death was recorded in the "JOURNAL" for Oct. 22, left £11,298; and Mr. Henry J. Robus, whose death the preceding Wednesday was announced in the same issue, left £9030.

THE WOODALL-DUCKHAM VERTICAL RETORT.

By A. M'D. Duckham.

[A Paper read at the Meeting of the Manchester District Institution of Gas Engineers, Liverpool, Nov. 30.]

Mr. Allen has asked me to give a description of the retorts erected on the Woodall-Duckham continuous system, which you have just inspected. As the plant has already been fully described in the Technical Press, it will, perhaps, be of more interest to you to listen to a short account of the principles of the process, the difficulties that have been encountered, and the results obtained. All here present must agree that continuous carbonization in closed retorts is an ideal method, provided the cost of the erection and running, and the results obtained, are on a commercial scale. The continuous coke extraction and coal feed reduces labour to a minimum; the absence of all waste in products and heat, and the constant conditions of working, produce considerable betterment of results. These advantages we have realized; and the success of our system is due to two main principles. First, the coke extraction is continuous, and automatically controls the rate of carbonization; and, secondly, the retorts are heated highly, more especially around the top.

The retorts are set four in a setting.* Below each retort is a plate which supports the charge in the retort. Over the plates reciprocates a pusher-device actuated from outside the setting. This reciprocating pusher ensures the continuous and constant discharge of the coke. At the top of each retort is a mouthpiece, and connected to this is the feeding device, consisting of a drum with a single mouth revolving in a casing. The continuous discharge of the coke from the bottom plate causes a continuous downward movement of the charge in the retort. The charge as it descends allows coal to flow into the retort from the feeding device; so that the discharge of coke regulates the rate of feed through the medium of the charge in the retort. The retorts are heated by burning the primary gases in the top of the setting, and by pulling the products of combustion down straight flues surrounding the retorts. Practically the whole of the surface of the retorts is exposed to the direct action of the flue gases. We have encountered two main difficulties in working our system—the extraction of the coke after it has been discharged from the retorts by the pushers, and the heating of the settings.

The coke is discharged from the plates under the retorts into a bottom chamber common to the setting. From this chamber the coke is extracted by a conveyor which passes through a water-seal, in order to ensure gas-tight working. The conveyor adopted is of a new type for this kind of work, and needed much modification before it operated with any satisfactory result. Engineers visiting our plants have always criticized this conveyor; and this criticism, combined with our experience, induced us to erect an installation at the Poole works of the Bournemouth Gas Company, in which the coke-conveyor is eliminated.

When designing the settings, we did not fully appreciate the fact that we were working contrary to Nature, and that considerably more draught and larger flues are needed when the hottest products of combustion are pulled downwards. As has been mentioned, it is essential that the charge should move continuously down the retorts. In practice, we find that if the retort is not sufficiently highly heated, the charge will not travel freely through it. Poor heats also mean poor makes and a large yield of tar. Considerable notice has been taken lately of the fact that in "discontinuous" vertical retorts, as Dr. Colman calls them, pressure is evolved at the bottom. It may interest you to know that, while our retorts are working, the pressures at the top and bottom are practically the same. But should, for any reason, the movement of the charge be stopped, pressure nearly always shows itself at the bottom; and this will mount up to 4 to 6 inches. This pressure is caused by the coal caking over in the primary carbonizing zone of the retort, and is easily freed by breaking the charge up in this zone with a rod inserted at the top of the retort.

There are at present three installations of retorts on our system erected and working—the installation of eight retorts here at Linacre, a similar installation at the Nine Elms Station of the Gaslight and Coke Company, and the sixteen retorts at Bourne Valley works of the Bournemouth Gas and Water Company. The settings at Linacre at first gave much trouble with heats. We could not obtain a temperature of anything higher than (say) 1600° Fahr. in the combustion chamber. The amount of coal carbonized was, therefore, very small, and the results disappointing. We obtained improved heats by introducing a second chimney shaft and by putting a steam-injector in each shaft. The heats improved very much indeed; but we began immediately to be troubled with leaking retorts. The surrounding brickwork had expanded upwards more than the retorts, and caused the latter to part at their top joints. We have shut down to repair these joints, and have succeeded for a short period; but almost immediately the leaks have re-appeared. With Mr. Allen's permission, therefore, we have decided to shut down the plant after your inspection and to re-set the top sections of the retorts quite free from the main brickwork surrounding them.

In London, though at first we had trouble with the heats and conveyors, we have obtained satisfactory results. The Gaslight and Coke Company have recently completed a six days' test on our installation; and Mr. Goulden has kindly given us permission to place these figures before you. [The figures submitted by the author were those given in the "Journal" for Nov. 12 last, p. 477, in connection with an article dealing with the Nine Elms installation.]

The candle power and calorific value combined with the high make of gas are interesting, though we feel we shall be able to obtain even better results with conditions improved by the knowledge we have gained on these settings. A satisfactory point is that at Nine Elms we have had a very large variety of coal given to us to carbonize. We have had no trouble in carbonizing any particular kind of coal, and are convinced that practically any coal is suitable for working in our retorts.

The Bourne Valley works of the Bournemouth Gas and Water Company have been shut down during the summer months, and all the gas made at Poole. Results obtained from the verticals in the early summer were published with a description of the plant. The average results were 13,021 cubic feet of 14·20-candle power and 546 B.Th.U. per ton. These settings have now been started up for the winter, and are working perfectly. The make is 12,500 to 13,000 cubic feet of 16-candle gas per ton.

As mentioned previously, we have erected a trial installation at the Poole works. The retort and mechanical parts are self-contained; the coke being extracted without a conveyor. The coke is quenched by a water spray, and is delivered perfectly dry. We have had a sample of this coke sent here, so that you may inspect it for yourselves. The installation at Poole is carbonizing 64 cwt. of coal per retort per 24 hours. The experimental plant erected to treat, test, and measure the gas made has only been completed this week; so that we cannot give you any figures as to make, &c. But we are satisfied with the new arrangement of coke delivery. The mechanical parts are so simple that they need no attention; and there is a minimum of wear and tear. We hope in the near future to have installations embodying this new feature erected at home and abroad.

I am afraid I have trespassed on your time; but the subject is such a large and interesting one that it is difficult not to grow enthusiastic and dilate upon the working and advantages of the system. Before closing, I should like to express our deep gratitude to the Liverpool United Gaslight Company, to Mr. Allen, and to Mr. M'Ewan for their kind encouragement and assistance. The running of a new process is a trying business; but it is made pleasant when one receives such support from the chiefs, assistants, and workmen as we have both here and in London.

A Question and the Reply.

Mr. Duckham asked to be allowed to add that he had received a message from Bournemouth to say the previous day the make from the settings was 12,600 cubic feet of 16·47-candle power gas per ton of coal. They had been carbonizing now for six weeks in the Bournemouth retorts; and among the coals used was one from Somerset—one of the worst gas coals; but it was going through the retorts very satisfactorily. They had now, as he had explained on the works that afternoon, abolished the old extracting arrangement, and had adopted a simple device for taking the coke from the retorts.

The President said they thanked Mr. Duckham for this lucid explanation of the vertical retort plant. He was quite sure the members trusted that all that was claimed for the novel system would in due time be reached. They wished Mr. Woodall and Mr. Duckham every success. As an institution, they were always anxious to see new processes, and that was one of the reasons they had such a large gathering of members that day.

Mr. J. G. Newbigging said there was only one question he should like to ask Mr. Duckham. It was what was the fuel consumption for heating the retorts. He had never seen a statement on the point in any returns of the working of the retorts.

Mr. Duckham replied that they had had run a test of five or six weeks at Bournemouth; and they had got down to 15 per cent. of fuel. Sometimes under the old system of working, their coke came out quite wet, and contained as much as 15 to 20 per cent. of moisture. Over an extended period of working they had got the fuel consumption down to 15 lbs. of coke per 100 lbs. of coal. When they heated up in the right place and in the right manner, as they did in the new setting at Poole, he thought the consumption would be lower than the figure mentioned. He should like to thank the President for his kind words. He was sorry that Mr. Woodall could not be present; but if any of the members had a keen interest in the matter, Mr. Woodall would be very pleased to see them at Bournemouth to inspect the Poole setting.

* See photo., p. 707.

A water purification plant of special interest is now being built for the Union Stock Yard and Transit Company at Chicago. In order to increase its supply, the Company proposed to take water directly from the peculiarly foul dead-end of the Chicago River, known as Bubbly Creek, and to treat it by some purifying process. An experimental mechanical filter plant was built, using sulphate of iron, sulphate of copper, and caustic lime. On the basis of the results obtained, a plant of 5 million gallons daily capacity is now being built. The Health Department, however, has made objections to the use of this water for any purposes except washing and flushing.

EXTENSIONS AT THE PAISLEY CORPORATION GAS-WORKS.

Inspection of the Works.

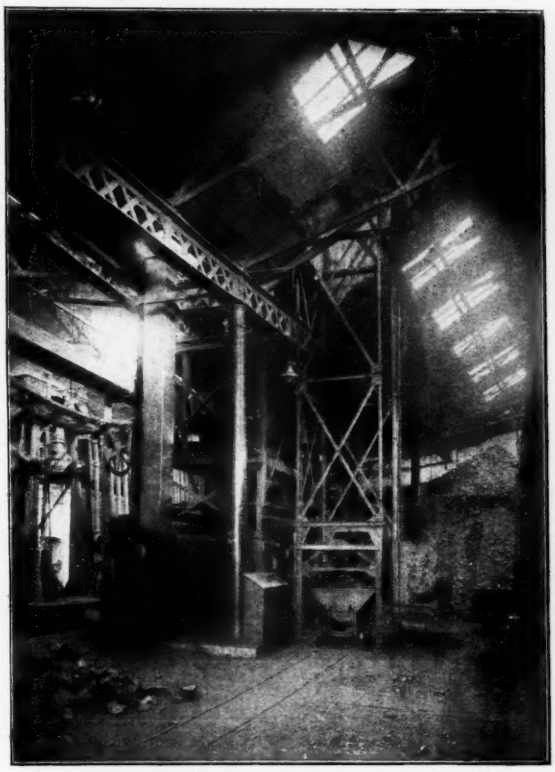
Last Wednesday afternoon, a party of invited guests, including a large number of gas managers in Scotland, assembled at the Paisley Corporation Gas-Works, to view the extensive additions to the plant which have been, or are in course of being, made there, under the direction of Mr. G. R. Hislop, the Engineer. The visitors were received by Provost Eadie and Mr. Hislop, and were conducted over the works; Mr. Hislop giving explanations as they proceeded. The total cost of the work to which attention was called has been about £19,000.

There are two sets of coal-elevators, worked electrically, each designed to lift 20 tons of coal per hour, or 480 tons per 24 hours. The coal is brought to the elevators in 10 cwt. waggon-loads run over rails and turn-tables laid throughout the stores. Before being placed on the elevator, each waggon is weighed on an Avery recording machine. It is then elevated and tipped into the hopper of the breakers; the coal returning to the floor automatically. The elevators are operated by two 2½ H.P. motors. The Contractors were Messrs. Babcock and Wilcox, of Renfrew.

Working in conjunction with the elevators are two sets of coal-breakers, supplied by Messrs. W. J. Jenkins and Co., Limited, of Retford. A special feature of these machines is that they screen out and bye-pass all the coal of 3-inch cube size and under, while only the rounder coal passes through the breakers. Both classes meet at the bottom of the machine, and are dealt with by the conveyor. The breakers are each operated by a compound-wound 15 B.H.P. motor, running at 480 revolutions per minute off a 230-volt circuit.

The coal-conveyors, supplied by Messrs. Babcock and Wilcox, consist of two main and two secondary or cross conveyors, working on the gravity bucket principle. The broken coal is run from the bottom of the breakers into a feed wheel (rotated by means of gearing) into the chain carrying the gravity buckets. Openings are provided round the periphery of this hollow wheel, and distanced to correspond with the centre of each gravity bucket as it passes under the wheel to get filled. The coal is conveyed thence to a central tower, from which it may be either transferred from the one main conveyor to the other or along one of the two cross conveyors to fill any or all of the storage bunkers, of which there are eight erected out of the twelve required, and which are each of 16 tons capacity. A special feature of the system is that the coal can be readily passed through either set of conveyors and to any line of bunkers, so that in the event of a breakdown in one set of elevators and conveyors, the other is more than sufficient for the work. The combined conveying plant is operated by two 5 H.P. and two 3 H.P. enclosed motors.

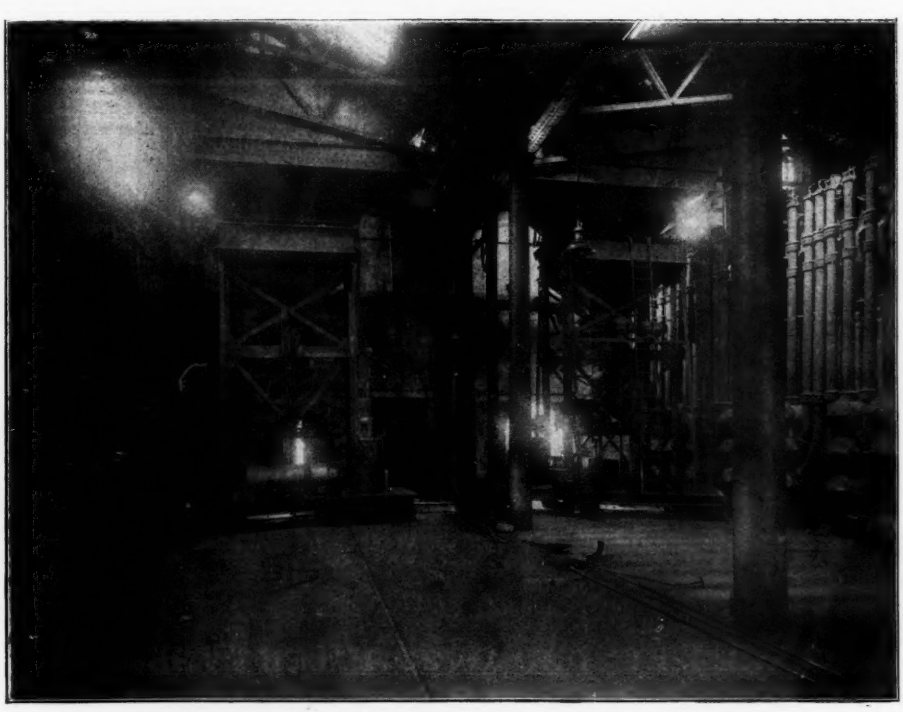
The charging of the retorts is done by De Brouwer machines, furnished by Messrs. W. J. Jenkins and Co., Limited. Four machines have been installed, one to each of four lines of retorts, and are wholly operated by electric motors, three for each, or an aggregate of 12¼ H.P. The coal is shot into the crown hopper of the charger, and descends through a telescopic shoot on to the discharging wheel and band, which are driven by a 4 H.P. motor. The machines are run upon suitable rails laid along the floors. Retort dischargers are inadmissible, for want of space.



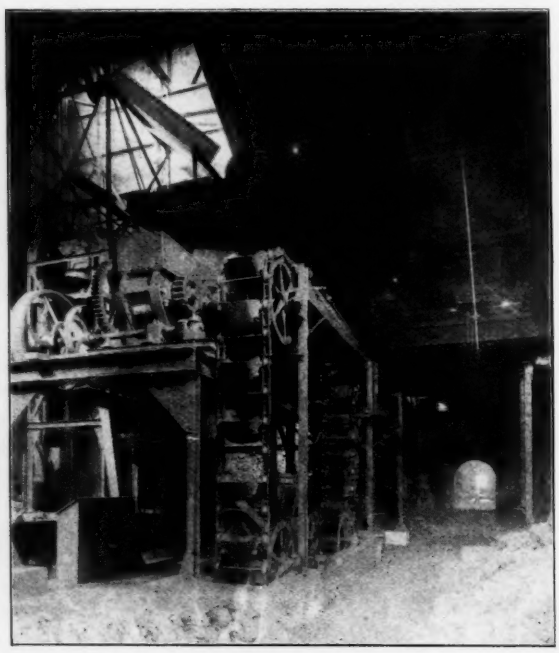
Coal Elevator and Breaker.

Five hydraulic main governors have been fitted up by Messrs. Bruce Peebles and Co., Limited, of Edinburgh. There are four of 10-inch and one of 12-inch size. Messrs. Harrison and Sheard's mercurial gauges, by Messrs. Parkinson and W. & B. Cowan, Limited, of Edinburgh, have been placed.

Water-tube condensers, by Messrs. Clapham Bros., Limited, of Keighley, are capable of condensing 3 million cubic feet of gas per 24 hours. They are in two sections, each of 1½ million



The De Brouwer Charger.



Coal Breaker and Conveyor.

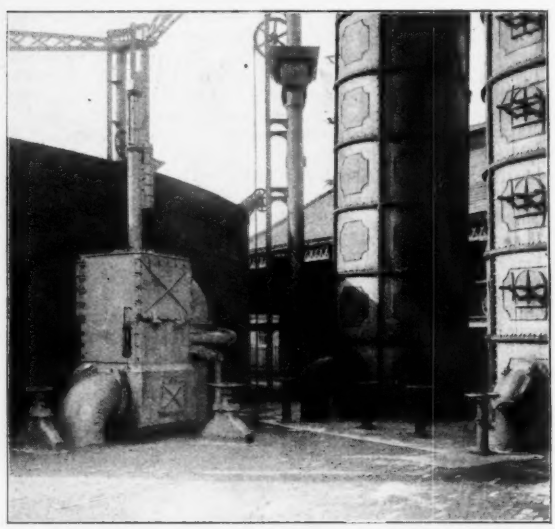
cubic feet. In each condenser there are 256 wrought-iron tubes, 1¼ inches internal diameter, through which the water passes—the gas going through the intervening spaces. The supply of the latter is adjusted to the volume of hot gas passing through; and by suitable valves the gas and water alike may be reversed in their passage through the condensers. By this means the condensers may be made self-cleaning. A tar-extractor, by the same makers, is placed upon a 24-inch foul main between the exhausters and the scrubbers.

Coke handling and screening plant has been furnished by the Temperley Transporter Company (now Messrs. Applebys Limited). It consists of a track, in the form of an elongated horseshoe, 409 feet long, with electric crab transporters, travelling upon rolled steel H-beams, at a height of 35 feet. There are two electric crabs. The capacity of the lifting skips is 12½ cwt. to 14 cwt., at a speed of 60 feet per minute, and a travelling speed along the track of from 500 to 600 feet per minute. They are worked on a continuous circuit of 230 to 250 volts. Trolleys take up the current from overhead wires. A driver's cage is fitted to each of the crabs, to protect the driver in all weathers; and by means of the patent fall-blocks he can lower to any desired extent, and tip the skip automatically, thus avoiding undue breakage of the coke. The screening plant consists of two sets, electrically driven. The coke and breeze fall into separate hoppers, under which the carts are placed. A cart can be filled in two minutes.

For the purifying materials there are two sets of transporters, similar to those for handling the coke—one in each bay of the double roof, and running upon beams supported independently of the roof.

The power required for all the machinery is derived from two "National" gas-engines of 71 B.H.P. (maximum), and a constant working load of 65 B.H.P. at 210 revolutions per minute, using gas of 600 B.Th.U. They are fitted with magneto-electric ignition. The dynamos (two in number) are of the multipolar continuous-current, compound-wound, "Witton" type; each being capable of giving 37 kilowatts with an electro-motive force of 250 volts, at a speed of 870 revolutions per minute. The dynamos are fitted with belt-tightening gear and slide rails; and the engines are provided with a special water-tank. The entire installation consists of the two gas-engines and dynamos and 26 electric motors. One of the engines is driven by town gas and the other by suction gas, the plant for which was erected by the National Gas-Engine Company, Limited, who also furnished the engines. The electric plant was supplied by the General Electric Company of Glasgow.

In the course of the walk through the works, Hislop's patent regenerative system of boiler-firing, though not quite new, was shown at work in connection with a Babcock and Wilcox boiler and two Lancashire boilers. The gas is made from coke or coal in an ordinary shallow producer. In this case coke was being used.



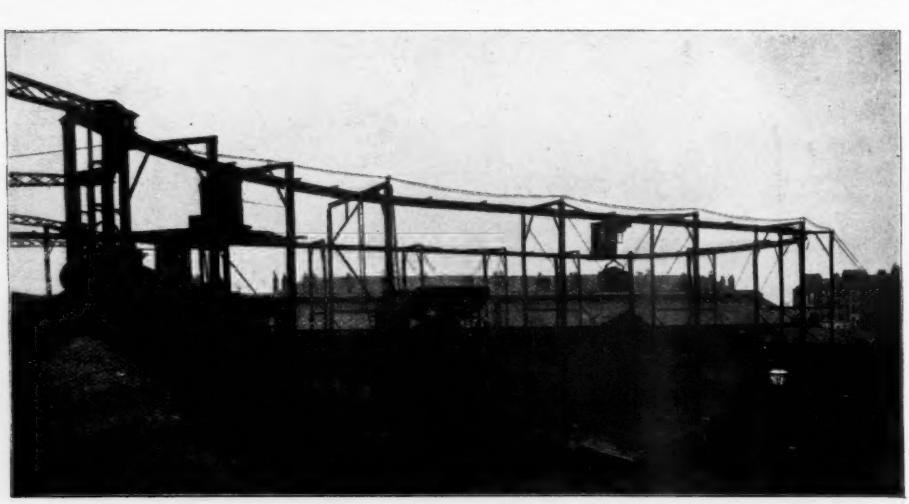
The Tar Extractor.

The abolition of stoking, and its attendant dust and dirt—giving the boiler-house an appearance of tidiness quite in contrast to the usual conditions—was the first noticeable feature of the place. Close inspection revealed the enormous saving of labour and attention involved, and the amount of heat derived, as well as the complete control which it had over the heating. The firing is practically automatic, after the producer is filled; and its value is found in efficiency, economy, and cleanliness—the economy consisting in the saving of fuel and in the longer life of the furnaces and boilers.

There is in course of erection a sulphate of ammonia house, alongside of which appliances are being put up for the purification of spent liquor by the Radcliffe chemical process.* Specimens of the effluent, untreated and treated, were shown, indicating the capabilities of the process.

A very handsome and commodious lavatory, for the use of the workmen, has been erected contiguous to the retort-house, the purifier-house, and the Temperley conveyor.

* Some particulars of this process were given in an article by Mr. Radcliffe which appeared in the "JOURNAL" for Oct. 2, 1906 (p. 22).



Coke Conveyor.

Complimentary Dinner.

At the conclusion of the inspection at the gas-works, the party were entertained at dinner in Gibson's Rooms, High Street—Provost EADIE presiding.

Mr. W. J. JENKINS, in proposing the toast of "The Town Council of Paisley," said it had been a great pleasure to all the visitors to see the Corporation's excellent gas-works, as it was quite a treat for an engineer to walk through gas-works in which there were so many mechanical appliances. They did not see, in Paisley, enormous sums of money spent on ornamental buildings; they saw a place fitted up for doing business.

Provost EADIE, in response, said he once had the ambition to be a gas manager; but it was never realized. Time, however, had brought about its revenges, for was he not that evening at the head of a noble company of gas managers? While he never was able to become a manager, he had the great pleasure for many years of making the apparatus necessary for the production of gas, and had had charge of the erection of such apparatus in various parts of the world. When he was returned to the Town Council, he was very soon sent to the gas-works. He found that if there was one thing more than another which they should be proud of in Paisley it was that they had so efficient a Gas Manager. He should not like to mention how long Mr. Hislop had been their Manager; but he would say this, that his eye was not dimmed nor his natural force abated! He (Provost Eadie) hoped Mr. Hislop would be long spared to them and to the gas profession. Gas was a young industry—not much more than a hundred years old—and it was discovered by a Scotsman, of whom, naturally, they were all proud.

Bailie KILPATRICK proposed "The Contractors."

Mr. J. W. R. COX, of Messrs. Babcock and Wilcox, Limited, and Mr. W. WARD, of the General Electric Company, responded; the latter remarking that in the Paisley Gas-Works they had one of the finest illustrations of the co-operation of gas and electricity.

Mr. H. C. TEMPERLEY proposed "The Engineer." He said he was glad to have the opportunity of thanking Mr. Hislop, on behalf of all the Contractors, for the fair treatment and the courtesy they had received from him during the time they had been carrying out their various works.

Mr. HISLOP, in acknowledging the toast, said he trusted that what the visitors had seen would in some measure compensate them for having come—at all events some of them—from a great distance. In the earlier years of the gas industry, managers were inclined to be more conservative and bigoted in their ideas than they were now. On every gas-works gate in the country were to be found the words, "No Admittance except on Business." This had given place to a happier state of matters, for there was now a kindly interchange of sympathy and experience all round. Their visit to the gas-works that day was a demonstration of this fact. They were all proud of their profession, universal as it was in its application, and glorious in its service to mankind. The position of gas engineer had, no doubt, increased in responsibility during the past twenty-five years. But they must not rest in the security of believing in the excellence of gas. They must double their diligence, and pursue their calling with determined perseverance, or they would not be in the race for the mastery. They had much to do. The qualifications of a gas engineer were very different now from what they were when he began, because a manager at the present day must not only know his own business but be familiar with many other things. He must be a chemist and an experimentalist; and if he was not an inventor he ought to be one. In conclusion, he said he could assure the visitors that he had had the utmost satisfaction with the Contractors, on account of the way in which they had done their work.

Mr. T. S. CLAPHAM proposed "Our Guests," which was responded to by Mr. BLAIR, of Helensburgh.

At the end of the toast-list, the company joined in singing "Auld Lang Syne."

Evening Star Lodge, No. 1719.

At the meeting of the Lodge last Wednesday, under the Mastership of W. Bro. W. T. Dunn, a very successful ladies' night was enjoyed at the Gaiety Restaurant. The members of the Lodge, with a large number of lady friends, were received by Mr. and Mrs. Dunn, and subsequently dined together; while afterwards there was a miscellaneous musical and variety entertainment. At the meeting of the Lodge, Bro. Glover Clark, S.W., was elected W.M. for 1908; and W. Bro. H. J. Davis was appointed Treasurer of the Lodge in succession to W. Bro. Thomas H. Martin, of Barnet.

Association of Water Engineers.—As already announced in the "JOURNAL," the twelfth winter meeting of the Association will be held on the 14th inst., at the Geological Society's rooms, Burlington House—Mr. Christopher Sainty, M.I.Mech.E., the President, in the chair. We learn from the circular issued by the Secretary (Mr. Percy Griffith, M.Inst.C.E., F.G.S.) that, in addition to the ballots for the Council and officers for 1908-9 and for new members, &c., three papers will be submitted for discussion: "The Water Supply of Malvern," by Mr. W. Osborne Thorp, Surveyor and Water-Works Engineer to the Malvern Urban District Council; "Notes on the Water Supply of Paris and Suburbs," by Mr. Easton Devonshire, Assoc.M.Inst.C.E.; and "Underground Water—the Right of User in the Light of Recent Enactments," by Mr. Alfred B. E. Blackburn, B.Sc., Assoc.M.Inst.C.E., F.G.S. In addition, a paper on "The Influence of the Thickness of the Pipe Wall on the Rate of Discharge of Water from Minute Orifices Piercing the Pipe," will be presented by Mr. W. R. Baldwin-Wiseman, M.Sc., Assoc.M.Inst.C.E.

DETERMINATION OF BENZENE IN GAS.

By D. A. MORTON.

[From the "Journal of the American Chemical Society."]

The value of benzene vapour as a light producer in illuminating gas has led to its extensive use for enriching purposes, and its exact estimation in a simple way has become a matter of consequence. Since 1 per cent. only in coke-oven gas gives a lighting value of more than 12-candle power, while 1 per cent. of ethylene gives less than 1½-candle power, there is a large difference in the lighting value of these constituents, and their separate determination is necessary.

Though a number of methods have been proposed for the determination of benzene, and some of them requiring long and careful manipulation are quite exact, none appears to be satisfactory for use in technical work where a simple and rapid, as well as reasonably accurate, test is desired. W. Misteli, in a recent review, cites the method of Haber and Oechelhaeuser as being the only one suitable for testing small quantities of gas;* yet even this method does not compare in rapidity and simplicity with the ordinary volumetric tests in technical analyses. The gist of the method is the absorption of the ethylene by bromine water and subsequent titration of the excess of bromine. Benzene vapours, the authors claim, while dissolving completely or partially in the bromine water, do not unite chemically with the bromine, and hence do not affect the titration. Only by long contact is there a slight reaction with the benzene. The difference between the ethylene found and the total illuminants is taken as the percentage of benzene.

The method of Dennis and O'Neill, published in 1903,† in which the benzene vapours are absorbed by shaking the gas in a pipette with ammonium nickel nitrate solution of prescribed strength, is, unlike the preceding method, simple and rapid, and suitable in these respects for technical use. The nickel method was used for a considerable time in my laboratory because, on account of its convenience and supposed accuracy, it was presumed to be suitable for the purposes here required. Nevertheless on a number of occasions the tests were found to be incorrect, and, consequently, a more exhaustive investigation of its merits was finally carried out, with results of such interest that I give them in detail below.

The Ammonium Nickel Nitrate Method.

The ammonium nickel nitrate solutions for the experiments were made up according to the directions given in the original article. Both the regular solution and Geer's solution were tried, with identical results; and, since the solutions were made up by more than one analyst and at a number of different times, we cannot suppose the errors found in the tests to have been due to errors in preparing the solutions.

Following the directions of the authors in carrying out the tests, mixtures of benzene vapour and air were analyzed; 100 c.c. of the gas mixture being shaken three minutes in an absorption pipette with the ammonium nickel nitrate solution, and then three minutes in a second pipette with 5 c.c. of 5 per cent. sulphuric acid over mercury to remove ammonia fumes. The decrease in volume by this treatment indicates the percentage of benzene. Table A shows the results obtained. The percentage of benzene present in each case was determined by absorption with fuming sulphuric acid, as in the regular way for illuminants. Besides the percentage of benzene present and that found by the ammonium nickel nitrate test, the table gives the quantity of benzene vapour (in cubic centimetres) previously absorbed by the reagent; for this has a decided influence, as will appear.

TABLE A.

	Benzene Present. Per Cent.	Benzene Found. Per Cent.	Benzene Vapour previously Absorbed. Cub. Cent.
1.	0·0	− 1·10	17
2.	0·5	0·00	17
3.	0·6	0·10	17
4.	0·6	0·30	1
5.	4·3	3·30	8
6.	4·7	3·20	12
7.	0·5	0·35	—
8.	1·0	0·70	—
9.	1·8	1·40	—
10.	4·2	3·70	—

A glance at the figures given in the table shows that the absorbing solutions must be perfectly fresh to obtain results which are even approximately correct. In tests Nos. 2 to 6, though at most only a small quantity of benzene vapour had previously been absorbed, in no case has more than three-fourths the benzene actually present been found by the test. In test No. 1, 100 c.c. of air, shaken with the reagent and the 5 per cent. sulphuric acid, has increased the volume to 101·1 c.c.

If fresh ammonium-nickel nitrate solution and fresh 5 per cent. sulphuric acid are used for each test (Nos. 7 to 10), the results are better, though still too low by several tenths of 1 per cent. In technical works, where complete analyses have sometimes to be made as frequently as once an hour, refilling the pipettes with fresh solutions for every test is an inconvenience which is best

* See "JOURNAL," Vol. XCIII., p. 291.
† *Ibid.*, Vol. LXXXIII., p. 369.

avoided. An improvement has been made in the laboratory of the Detroit Solvay works, where the gas mixture is shaken three minutes in each of two ammonium nickel nitrate pipettes—thus keeping the contents of the second pipette comparatively fresh for some time.

On further examination, we find not only that the ammonium nickel nitrate solution is an indifferent absorbent for benzene, but also that the absorbing power it does possess is due, not to the nickel compound but to the water present. That either water alone or dilute aqua-ammonia gives practically the same results as the ammonium nickel nitrate solution is shown in Table B, giving the results of comparative tests.

TABLE B.

Absorbing Solution.	Minutes Shaken.	Benzene Present. Per Cent.	Benzene Found. Per Cent.	Benzene Vapour previously Absorbed. Cub. Cent.
I.				
Ammonium nickel nitrate	3	9·9	9·0	—
Aqua-ammonia (sp. gr. ·95)	2	9·9	8·8	—
Water	3	9·5	8·1	—
II.				
Ammonium nickel nitrate	3	9·9	8·0	9·0
Aqua-ammonia (sp. gr. ·95)	3	9·9	8·2	8·8
Water	3	8·4	7·4	8·1

III.

No. of Test.	Benzene Present. Per Cent.	Benzene by Ammonium Nickel Nitrate. Per Cent.	Benzene by Water. Per Cent.
1.	0·50	0·35	0·40
2.	1·00	0·70	0·80
3.	1·80	1·40	1·50
4.	4·15	3·65	3·40
5.	3·95	—	3·50
6.	4·15	3·60	3·35

Table B shows results from a number of tests made under conditions as nearly identical as possible in all comparative cases. In Series I., fresh absorbing solutions were used. The gas taken for the test was air containing benzene vapour; 100 c.c. of the gas being passed into the absorbing pipette and shaken with the absorbent for the number of minutes indicated, drawn out and passed into a pipette of 5 per cent. sulphuric acid to remove fumes, then back into the burette, allowed the usual time to drain, and measured. In Series II., the same conditions were observed, except that the absorbing solutions were not fresh, having been used for the tests under Series I. In Series III., the gas in each case was shaken with the fresh reagent for three minutes, and then with 5 per cent. sulphuric acid for three minutes; the tests all being made with especial care.

TABLE C.

Series.	Absorbing Solution.	Minutes Shaken.	Benzene Found Per Cent.	Benzene Present. Per Cent.	Benzene Previously Absorbed. Cub. Cent.
I.	Ammonium nickel nitrate	2	6·1	7·2	—
	Water	2	6·0	7·2	—
II.	Ammonium nickel nitrate	3	2·3	3·6	6
	Water	3	2·3	3·6	6
III.	Ammonium nickel nitrate	2	0·4	1·0	—
	Water	2	0·4	1·0	—

Table C shows the results of strictly comparative tests of the absorbing power of ammonium nickel nitrate solutions and pure water. In each case, exactly 118 c.c. of the absorbing solution were shaken for the time stated with 100 c.c. of the gas, and the unabsorbed residue was drawn slowly back into the burette and measured. The gas was drawn back slowly to insure complete absorption of all the ammonia fumes. [One hundred cubic centimetres of air passed into the fresh ammonium nickel nitrate solution, shaken one minute, and drawn back in the same way, re-measured exactly 100 c.c.] The temperatures were the same—18° to 19° C. in all instances. In each case the gas tested was a mixture of air and a known quantity of benzene vapour.

From the results given in Table B, we can draw no other conclusion than that in the determination by ammonium nickel nitrate solution the benzene vapour is simply dissolved to a certain extent by the water in the solution—perhaps increased slightly by the ammonia in the case of the high percentages; but that the presence of the nickel compound has no appreciable influence whatever.

It would answer better to simply use fresh water each time as the solution for absorbing benzene; and, if used under proper conditions, good results could perhaps be obtained with this reagent. Nevertheless the use of a fresh solution, even water, for every test involves certain inconveniences and liabilities to error, and would be objectionable in technical practice.

By the use of concentrated sulphuric acid for the benzene absorption, a better method is obtained. This method is reliable and convenient; and the results by it are so comparatively accurate that I have no hesitation in recommending it for the technical analysis of coal gases.

The Concentrated Sulphuric Acid Method.

The marked solubility of benzene vapour in water (see Tables B and C) renders necessary certain precautions in sampling and handling the gas previous to the test. If taken over water, the sample bottle should be completely filled with the gas, driving out practically all the water, as otherwise some of the benzene will be absorbed. After the determination of the carbon dioxide in the gas by absorpton in strong caustic soda or potash solution in the usual manner, the benzene test is accomplished as follows (caustic soda solution dissolves benzene to only a very slight extent, and the error caused thereby is negligible): The gas residue is passed into an ordinary simple absorption pipette containing concentrated sulphuric acid (sp. gr. 1·84) and shaken vigorously with this reagent for one minute, by which treatment the benzene vapours are absorbed. [Slight dilution of this acid does not detract from its efficiency, but the dilution should not exceed 2 per cent.] The shaking is satisfactorily accomplished by giving a quick, sharp motion to the pipette in such a way as to mix the contents thoroughly about twice per second during the specified one minute. It is essential to shake vigorously with the sulphuric acid as directed, for the last traces of benzene are absorbed slowly and require thorough contact with the acid.

Experimental data on the conduct of concentrated sulphuric acid as an absorbent for benzene are given in Tables D to G.

TABLE D.—*Benzene-Air Mixtures.*

No. of Test.	Benzene Present. Per Cent.	Benzene Found. Per Cent.	No. of Test.	Benzene Present. Per Cent.	Benzene Found. Per Cent.
1.	0·50	0·5	6.	3·6	3·55
2.	0·60	0·6	7.	4·0	3·80
3.	0·65	0·6	8.	4·5	4·35
4.	1·90	1·9	9.	4·7	4·60
5.	3·00	3·1	10.	7·8	7·70

TABLE E.—*Benzene-Air Mixtures.*

No. of Test.	Gas Tested.	Benzene Vapour previously Absorbed. Cub. Cent.	Benzene Present. Per Cent.	Benzene Found. Per Cent.
1.	Benzene-air	55	1·9	1·9
2.	,,	120	3·0	3·1
3.	,,	150	4·5	4·3
4.	Air	55	0·0	0·0
5.	,,	100	0·0	0·0

TABLE F.—*Benzene-Ethylene-Air Mixture.*

No. of Test.	Benzene Present. Per Cent.	Benzene Found. Per Cent.	Ethylene Present. Per Cent.	Ethylene Found. Per Cent.
1.	0·55	0·85	9·50	9·5
2.	0·50	0·70	10·10	10·0
3.	0·50	0·65	4·80	4·7
4.	0·50	0·60	5·00	4·8
5.	1·00	1·05	9·95	10·1
6.	1·00	1·00	4 80	4·8
7.	1·00	1·05	5·00	5·0
8.	2·85	2·85	4·40	4·6
9.	3·00	3·00	4·50	4·7

TABLE G.—*Ethylene Absorbed in the Benzene Test.*

Ethylene Present. Per Cent.	Benzene Present. 0·0 C.c.	0·5 C.c.	1·0 C.c.
1	0·05	—	—
2	0·10	0·05	—
3	0·10	0·05	—
4	0·15	1·10	0·05
5	0·20	0 10	0·05
6	0·25	0·15	0·10

Table D shows results obtained with mixtures of benzene and air. Good results are obtained even when more than 7 per cent. of benzene (a very high amount) is present. Table E gives results showing that the concentrated sulphuric acid can be used for a large number of tests without renewal. The benzene combines with the sulphuric acid and is not removed by air subsequently introduced. Table F shows the action of concentrated sulphuric acid on benzene-ethylene-air mixtures. The benzene is determined by the concentrated sulphuric acid test; and the ethylene immediately afterwards by fuming sulphuric acid in the usual way. In this table, a slight defect in the method appears, due to the absorption of a trace of ethylene by the concentrated sulphuric acid. Higher homologues of ethylene would be absorbed to a greater extent than would ethylene itself. The error diminishes rapidly as the percentage of benzene increases—becoming practically *nil* when 1 per cent. or more of the latter is present, and probably not exceeding 0·2 per cent. in the case of any coal gas. Table G shows the number of cubic centimetres of ethylene absorbed by the concentrated sulphuric acid test per 100 c.c. of gas, having given the percentage of benzene and ethylene present. By the use of these data, correction for the error can be made when desirable.

Conclusions.

From the results obtained, the unsatisfactory character of the ammonium nickel nitrate method is apparent. As pure water absorbs benzene to practically the same extent as the ammonium nickel nitrate solution, it appears that the method really depends on the solubility of benzene vapour in water or ammoniated water, and that the presence of the nickel compound has no influence. The results by the method are inaccurate and vary widely according to the amount of benzene in the gas and the quantity already present in the absorbing solution.

Concentrated sulphuric acid, on the other hand, absorbs ben-

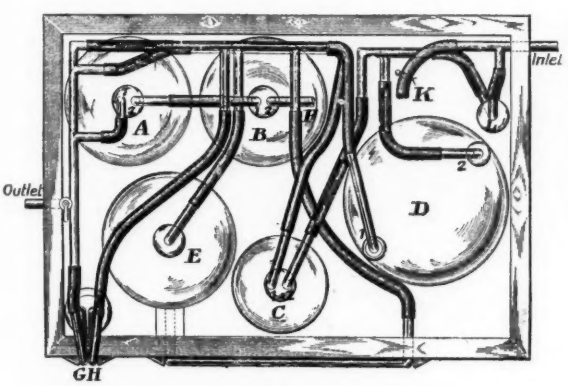
zene vapour as readily as could be desired, and can be used for a large number of tests without renewal—giving as accurate results after a hundred tests as when first prepared. The defect due to the absorption of ethylene is insignificant; but it may be easily corrected for (see Table G). Traces of the higher olefines, however, may give a value slightly too high for the benzene percentage, though this error, as shown by our tests of rich and lean gases from a variety of coals, must be small, if not inappreciable.

A NEW INDICATOR FOR CARBONIC ACID GAS.

By Charles B. Robison, of Nyack (N.Y.).

[**A Paper submitted to the American Gas Institute.**]

Since the earliest investigation aiming to develop the most economical method of operation of water-gas apparatus, it has been conceded that the production of carbonic acid gas must be kept down to a minimum, and that any unusual increase of this gas is the surest indication that something is wrong in the method of operation. However, constant determination of this gas has not been an easy matter, particularly with the smaller works, which cannot afford the constant services of a chemist. There have been several indicators and recorders put upon the market; but they are high in price, rather bulky, and require a considerable lapse of time from the moment the gas is produced in the furnace until the indication is given. Some months ago, my attention was called to a carbonic acid indicator that had just been invented by Professor Jones, the Chemist to the Metropolitan Street Railway Company of New York, to be used in connection with steam-boiler operation. This was a comparatively small and simple affair, and apparently easy to operate; and as its adaptability to the gas business immediately impressed me, one was at once purchased and set up at the works of the Company with which I am connected. It has met my expectations in every way. Indications were given in 40 seconds after the gas had entered the apparatus, and in less than a minute after it had left the generator.



The illustration is a top view of the instrument showing the interior; and the principle of operation can be best explained by quoting from the instructions for using the apparatus: "Two streams of gas to be analyzed are made to pass through solutions in two chambers at the same tension. The carbonic acid gas to be estimated is removed by absorption in one chamber and not in the other. This changes the tension in the chamber in which the absorption takes place. The tensions of these two chambers are made to oppose each other by connecting each with one end of a manometer; and the difference of tension of the gas in the two chambers is shown on the manometer scale, which is arranged to indicate the percentage of carbonic acid in the gas."

The method of charging the apparatus and putting it in action is a simple one. Pour carefully into the bottle E kerosene or coal oil of 150° fire test, until it shows on the indicating tube on the front of the box, and stands exactly at the 0 mark. Dissolve the contents of the package of sulphate of zinc in 34 oz. of water (this gives a solution of about 38° Beaumé gravity), and fill bottles A and B with the solution up to the top of the mark. Remove the stopper from the bottle C, and fill to the mark with the oil furnished. Dissolve 2 lbs. of stick caustic potash in 62 oz. of water; remove the stopper D 1, and fill this bottle to the top of the mark with the potash solution. Then put 1 oz. of glycerine into the small bottle in the left-hand corner, into which the tubes G and H are inserted.

The instrument is now charged; and, after standing to allow the temperatures to equalize, it is ready to be adjusted as follows: The small aspirator which is furnished with the indicator is connected to a water supply of a least 30 lbs. pressure, giving a fairly constant flow of clean water to ensure that there is no stoppage in the aspirator and fairly constant suction on the indicator. This having been done, connect the suction-tube with the outlet of the indicator. Now, slowly open the cock inside the box until the air bubbles through A and B in a quiet, steady stream. After this has been running a few moments, the glycerine standing in this column will be seen rising in the tube G. The height of the glycerine standing in this column can be regulated by increasing or decreasing the seal on tube A 2 or B 2, by raising or depressing them. Next notice if the glycerine in the tube H stands at the mark. If it is too high or too low, it can be adjusted by using the tube D 2 in the same manner as B 2. When these two adjustments have been made, remove the clip from the rubber F, letting it rest on the brass tube. The oil in the indicating-tube is now released, and will probably stand too high or too low. This is again brought to the 0 mark by using the tube C 2, but in the reverse manner. Depressing the tube lowers the oil, and raising it brings it up. The apparatus is now ready for use, and the box may be closed. It is important to note that the indicator should be situated so that no sudden change of temperature takes place within the box while the adjustment is made. The box should therefore be protected from sudden draughts of cold air.

Connect a ¼-inch iron pipe to the gas inlet of the carburettor, carry it close to the indicator, and from there allow it to open out of the building. A tap is made in this pipe where it passes the indicator, and a small stream of gas through a rubber tube is taken into the bottom of a bottle which is open at the top. Into this bottle insert the tube leading from the inlet of the indicator. The purpose of this connection is to prevent the indicator from being subjected to the violent changes in pressure which take place in the generator when a change is made from a "blow" to a "run," and to allow the water which condenses from the gas to be collected in the bottle and not be drawn into the apparatus. As soon as the gas from the bottle reaches the absorption bottle, any carbonic acid it may contain will at once be indicated on the manometer. The operation is now continuous; indication being given constantly.

In putting the indicator into operation, the following precautions to be observed were developed: The indicator should not be subjected to excessive temperatures, as it would be if set too close to the generator or the carburettor; neither should the gas taken into it be of markedly different temperature from that of the solutions in the absorption bottles, and great care should be taken to remove all particles of scale and grease from the water-supply pipe, as they are sure to block the aspirator and give endless trouble. If difficulty occurs in starting the apparatus, the action of the aspirator is the most fruitful source of it.

The financial loss caused by an excess of carbonic acid in gas is considerable. It is very possible to operate with 3 per cent. of it in the carburetted gas; yet the output from many plants contains 5 per cent. or more. The difference in the cost of oil between the 3 per cent. and 5 per cent. on an output of 100 million cubic feet would be at least $1000 (£200); and this is surely well worth looking after. The writer believes that the amount of carbonic acid produced at any time is the best standard by which to judge what is taking place in the generator, both while "blowing up" the "heats" and when making "blue" gas, and that an indicator making this knowledge constantly available will be of great value to the industry.

THE CHARGING AND DISCHARGING OF VERTICAL RETORTS.

In the "Journal" for the 29th of October (p. 348), an illustrated description was given of the method devised by M. Charles Rouveure for charging and discharging vertical retorts and coke-ovens. After the patent was taken out, the arrangements were modified in certain particulars, and made the subject of a second patent, from the specification of which the following details have been extracted.

On further considering the subject of the continuous automatic removal of coke from vertical retorts, M. Rouveure was led to simplify the parts of his apparatus by which the descent of the coke is effected. The racks and endless screws operating the trucks, which were found to be expensive, are dispensed with; and the chamber which extends the lower part of the retort has undergone some modification. It is now divided into two compartments by the central partition A shown in fig. 1, which is a vertical section of a twin setting of retorts. Each of these compartments is equal in size to the retort with which it is connected. As seen from the illustration (p. 714), on the upper part of the partition there is a horizontal rod B, upon which turns a plate or grid C, the object of which is to close alternately the upper opening of each of the compartments. When this oscillating plate or grid rests on the projection shown at the bottom of the left-hand wall of the retort, the coke coming from the two divisions of the retort falls into the right-hand compartment, and *vice versâ*. On the opposite sides of each compartment are guides D, in which slide friction-rollers G H mounted upon the plates E E^1, which are supported by rods operated alternately. The plates carry curved arms F forming grids. When one of the rods makes an ascending movement (as shown in the left-hand chamber), the upper part of the curved arm strikes the plate C, and causes it to turn upon its axis. When the roller H reaches the top of the slide, the plate E inclines, and the roller G, moving in its slide, describes the arc of a circle round H. Meanwhile, the rod has continued its descending movement; and the coke from the left

hand portion of the retort has gone partly into the right-hand compartment and partly behind the grid F. When by the movement of the plate E round the roller H the grid C has reached the vertical position, the plate E^1, which descends, begins to turn round the roller G, stopped at the bottom of the slide. The rotation of the plate E^1 allows the coke below, in the right-hand compartment, to fall into the hopper I. The grid C, which has already attained the vertical position, and has been pushed beyond it by the grid F, is drawn down by the mass of coke and by its own weight, and falls upon the projection at the bottom of the right-hand wall of the retort. Communication is thus established between the retort and the left-hand compartment. Before the descending plate E^1 has completed its discharge movement, the plate E has accomplished its impelling movement, by means of a special arrangement in the slide. It will thus be seen that the downward and upward movements of the rods take place symmetrically. The details of construction may be varied in several respects without changing the general arrangement of the appliance. The object of the invention is to ensure the continuous discharge of coke, and avoid obstruction in the interior of the retort. The coke must be removed at a minimum speed, depending upon the quality of the coal and the size of the retort. At the same time, carbonization must be complete, and there must be no uncarbonized portions in the middle of the mass of coal undergoing distillation.

Fig. 1.

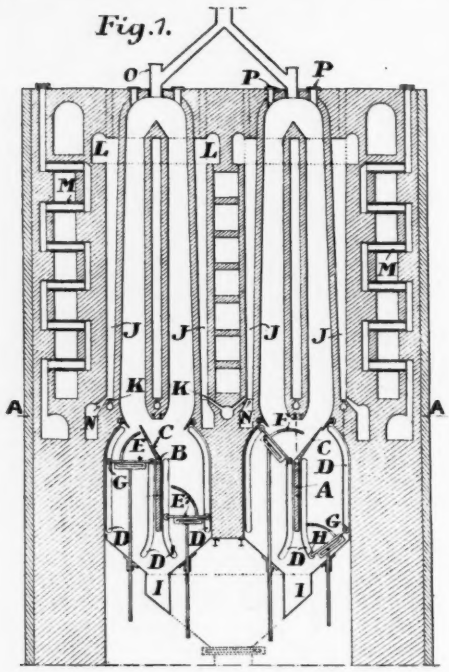
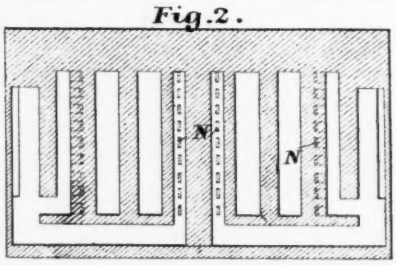


Fig. 2.



Rouveure's Vertical Retort.

In order to apply M. Rouveure's method of discharging coke to all systems of vertical retorts, it is necessary to fulfil the two conditions above mentioned. Recognition of this fact led him to devise a special type of retort for effecting the rapid, and at the same time complete, carbonization of coal. In the first place, its interior dimensions should be comparatively small. If, however, its capacity is very limited, the cost of an installation for a specified production is increased. In order that a retort having too large an area may not cause the formation of uncarbonized masses of coal, it is necessary to introduce a source of heat so as to accelerate the distillation of the central portion. The arrangement which appears most suitable to accompany M. Rouveure's system is shown in the illustration. It will be noticed that each retort is trapezoidal in its vertical section; while its horizontal section is preferably rectangular, as in fig. 2—a section on the line A of fig. 1. The walls of the retort are heated by vertical channels J, at the bottom of which gas arrives by the burners K. The burnt gases unite above in the collectors L, by which they are conveyed into a channel formed at the back part of the setting. From this channel, the burnt gases pass into other channels in the interior of the setting, flow down, and then enter a collector located in the fore part. From this collector they are conveyed to the base of the heat regenerators, which they traverse before passing up the chimney. The heating of the secondary air takes place in the regenerators M (the quantity to be introduced being regulated by a damper), and flows to the burners N. This arrangement makes the heating as equal as possible throughout the setting.

The charging of each retort is effected by one or more openings O, each of which should be fitted with the appliance described in the original specification; or several openings may be joined and served from one channel, as shown in fig. 1. In the latter case, the installation will be less costly. The waste gases are conveyed away by a chimney forming the outlet of a channel in the top of the setting, in which is fixed an inclined plate of refractory material for preventing carbonaceous fumes from being carried forward with the gas. The openings P allow of the insertion of a pricking-iron to assist the descent of the coal, should there be any stoppage; and with the view of further ensuring this, the top of the division wall of the retort, as will be seen, is made conical.

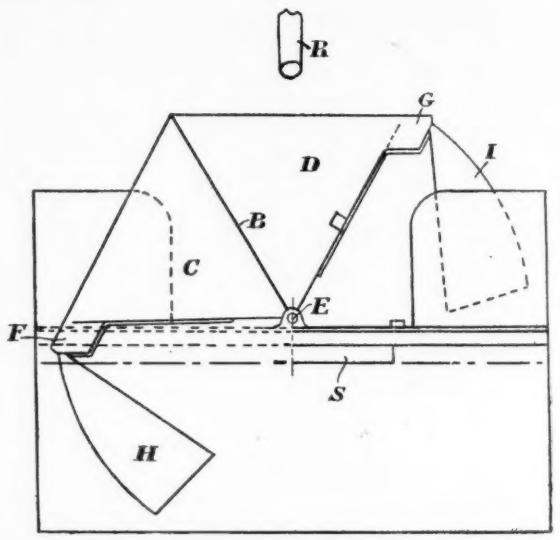
REGISTER OF PATENTS.

Liquid Meters.

M'Mahon, P. V., of Clapham Road, S.W.

No. 28,898; Dec. 18, 1906.

This invention relates to meters of the kind wherein the liquid to be measured is charged alternately into two measuring vessels pivoted to a common centre in such a way that when one receptacle is filled it overbalances and tilts the device, so as to bring the other receptacle into the position for filling and the filled receptacle into the position in which it empties; the quantity of liquid delivered in any time being estimated by counting mechanism employed in combination with the tilting device.



M'Mahon's Liquid Meter

The measuring vessel is of segmental or V-shape, is divided by the central partition B so as to form two triangular shaped measuring vessels C D, pivoted at their lowest point to the spindle E mounted in the casing. F G are extension chambers projecting beyond the measuring vessels respectively; and H I are tapering chambers forming dash-pots attached at their upper narrow ends to the extension chambers. Tubes extend from the necks of the chambers F and G into the measuring vessels, and open into the latter at points near the bottom. Rubber stops determine the position in which the vessel rests while either measuring chamber is filling. R is the pipe supplying the liquid to be measured, and S is an outlet whereby the level of the liquid in the casing is kept constant.

The apparatus being in the position shown when the liquid delivered through the pipe R enters the measuring vessel D, the air in the dash-pot I is sealed. The level of the liquid gradually rises; and when the vessel is nearly filled and the device is on the point of tilting, the remaining liquid flows into the extension G, and provides an additional weight situated at a greater distance from the fulcrum E than that of the main bulk of the liquid. This additional weight causes the vessel to quickly tilt, and "the point at which the tilting takes place can be determined with considerable accuracy." The air imprisoned in the dash-pot I renders the action of tilting smooth; and this air is released when, on the tilting of the device, the liquid is discharged from the vessel D—thus facilitating the return of the empty vessel to the filling position. The tilting of the device brings the vessel C into the filling position—the action of the dash-pot H being similar to that described for the dash-pot I.

Producing a Partially Coked Fuel.

PARKER, T., of Chapel Street, Edgware Road, W.

No, 17,347; Aug. 1, 1906.

This invention relates to the production, "by partial destructive distillation from coal," of a partially coked fuel of high calorific value, which, in combustion in an open grate, shall be practically smokeless, and is particularly applicable to the process described in patent No. 14,365 of 1906—the "Coalite" specifications (see "JOURNAL" for Oct. 8 last, p. 95).

In the distillation of coal for the production of such a smokeless partially coked fuel, the patentee says he has experienced difficulty in effecting complete gasification of the coal and in the production of a homogeneous partially coked fuel, by reason of the caking of the coal near the surface during the process of distillation, which causes not only the splitting of the coal and the formation of fissures within it, but also prevents the outlet of the gas from within the fuel, and thus renders impossible the production of a smokeless partially coked fuel of uniform character and homogeneity.

According to the present invention, he proposes to avoid this "serious difficulty" by applying heat in the process of distillation according to the earlier patent named above, "gradually and slowly, so that the process of distillation may first take place at the surface of the coal with such effect as to render the coal at its surface porous, and so that thus the process of distillation may continue by gradual penetration inwardly, and that thereby an outlet may be afforded for the liberation of the gases as they are generated within the coal, and thus the coal may be uniformly though partially destructively distilled."

Continuing his specification, the patentee says: The distillation is effected at very low temperatures; the maximum temperature being about 800° Fahr. It will, however, be understood that this particular maximum temperature may not be rigidly adhered to; but in every case the process of gasification, or the application of heat to the coal in the process, is arrested at the stage when illuminating gas ceases to come off, and when the presence of hydrogen and carbon monoxide is indicated by the characteristic flame. By thus arresting the process of distillation when practically all the illuminating gas has been driven off, a partially coked fuel results, which can readily be ignited, and which burns freely in an open grate without smoke—its combustion being such as to develop a very high temperature that contributes to this result. I find such a flame test a very convenient method of determining the duration of the process, and the application of heat in the process rendering unnecessary the employment of pyrometers or other aids to the determination of the temperature obtaining. It will be understood that, at the commencement of the process, the heat applied is slight, and that it is very gradually raised, so that the whole mass of coal under treatment may be uniformly heated, and the heat is gradually and slowly increased for the purpose stated.

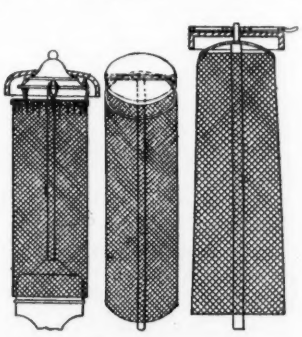
After mentioning that he "may employ any suitable means for controlling the application of heat to the fuel," he continues: "It will furthermore be understood that the invention involves the use of the process the subject matter of the prior patent, and that it is also one of the objects of the present invention, in addition to obtaining smokeless partially coked fuel, to produce an illuminating gas of high illuminating power as well as other valuable bye-products (such as tar and ammonia), which render the process of production of the fuel as described highly economical. It will be also understood that, after the partial destructive distillation has been completed, and for the purpose of cooling the fuel and preventing its combustion in air, I employ steam superheated or at normal temperature and pressure as in the process of the prior application referred to."

Incandescent Gas-Mantles.

NEMEROVSKY, F., of Manchester.

No. 23,950; Oct. 27, 1906.

The object of this invention is, firstly, to minimize the risk of fracturing the mantle by the explosion which takes place when lighting; and, secondly, to increase the illuminating power without increasing the consumption of gas, and "to prevent the accumulation of smoke and carbon."



Nemerovsky's Incandescent Mantles.

The illustration shows (1) a part sectional view of a mantle constructed with an open top suspended from an enlargement or head formed on the end of the pillar or support, over or upon which the cap or cover fits; (2) the cap or cover formed in one with the pillar or support; and (3) the cap or cover constructed on a ventilator principle and supported upon the pillar.

As shown, the mantles are open-topped, of one uniform diameter throughout or slightly tapered towards the top, and strengthened round the top by a double asbestos thread or fine platinum wire, with loops or their equivalents around the upper edge. The loops hook on to, or fit upon, projecting arms or lugs on the upper surface of an enlargement or head formed on the upper end of the fork or pillar. The cap or cover (made of suitable refractory material, to stand the heat) may be dome, flat, or other shape; and it fits on to, or over the top of, the head surrounding or covering the top of the mantle—a slight space being left between the upper edge of the mantle and the lower edge of the cap to allow the products of combustion to escape. In the alternative arrangement, there are straps or bands across the top of the mantle for supporting it on the cap or cover, which in this case is formed integral with the fork or pillar. The straps fit over the cap or cover, preferably by resting in grooves formed therein. In the third method, the cap or cover is constructed on a ventilator principle, to be opened when lighting the gas and then to be closed to keep the heat in the interior of the mantle.

By the use of a cap fitting over the top of the mantle, the patentee claims to be enabled to retain in the mantle a greater amount of the heat produced by the flame than is possible when the mantle is uncovered, with a consequent increase in the power of the light. She has also found by practical experience that not only is the power of the light increased, but the consumption of gas is decreased—remarking: "I have also found by the use of my cap or cover over the top of the mantle that I can form the mantles wider at the top without loosing any of the heat, and by this means I allow a free escape of the expanding gases when lighting up, thus preventing the top of the mantle from being shattered, which is frequently the case with mantles that are drawn or gathered in at the top as usually constructed. And, further, I have found that a mantle provided with a cap or cover as described, when lighted, will glow or burn to the top, even when the mantle is longer than usual, and without increasing the consumption of gas, and that the light does not fluctuate but remains perfectly steady, and also that very little or no carbon is formed."

Gas Washer and Cooler Combined.

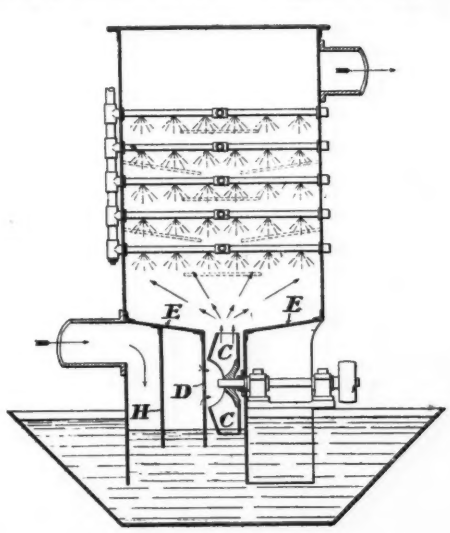
BENTLEY, G. H., of Levenshulme, Manchester.

No. 24,624; Nov. 3, 1906.

The patentee mentions that, in removing tar, dust, and other impurities from producer and like gas, and in cooling such gas prior to its entering the usual scrubber, it has hitherto been customary to effect the operations in separate stages and in separate apparatus—the impurities being removed by varying the velocity and traverse of the gas in one apparatus, and the cooling being effected by bringing the gas in contact with cooling surfaces in another apparatus. With such system of removing impurities and cooling the gas, some of the tar, &c., is often carried over with the gas—thus causing clogging of the apparatus, and serious difficulties in the continuous working of the plant.

As a result of experiments, he has found that to remove the dust, tar, &c., from the gas it is not strictly necessary to traverse the gas through an extended series of pipes, or to vary the velocity, and, further, that satisfactory results can be obtained by bringing the gas into contact with water and thoroughly mixing it with the water immediately it leaves the producer.

This being so, the present invention contemplates the construction of an apparatus in which the operations of both removing the impurities and cooling the gas may be effected, and in which the dust, &c., will be so effectually eliminated as to prevent clogging of the apparatus.



Bentley's Combined Gas Washer and Cooler.

The apparatus employed consists of an open-bottomed, tower-like casing mounted in a water-sealed tank. In the lower part is a rotary fan washer C; and, by means of suitable plates forming a casing, the washer is enclosed on all sides, except at bottom and top, and for a central opening D on one side. The fan washer and the bottom edges of the plates by which the washer is enclosed, dip slightly into the water seal. In the lower part of the casing is a floor or partition E, which is preferably inclined downwardly towards the upper end of the fan casing. In the upper part of the main casing is a series of high-pressure water jets supplied from a pipe common to all, delivering water downwards, shower fashion; the water falling upon the floor of the casing and then flowing into the fan casing and down its walls. In the lower part of the casing are also one or two slightly sealed partitions H.

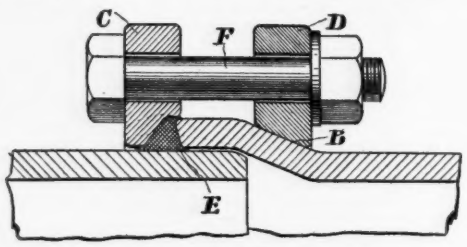
In work, the gas first enters the lower part of the apparatus, where (after passing under the plate H) it enters the central opening D of the fan casing. Meeting the fan (by which it is drawn into the casing) while rapidly rotating and while the water is thrown up by the fan, and also as the water flows down the inner walls of the casing, the gas becomes intimately mixed with water, and, under the centrifugal action of the fan, the impurities deposit in the lower part of the casing, where they sink to the bottom of the tank. At the same time the gas is projected upwards into the upper part of the casing, in passing through which it meets the showers of falling water, and becomes rapidly cooled and ready to pass to the scrubber, &c.

Joints and Connections for Pipes and Tubes.

BEWLAY, H., of Birmingham.

No. 25,061 ; Nov. 7, 1906.

This invention comprises improvements in wrought-metal spigot-and-socket pipes, and has for its object the application of a joint on the sliding-collar packing principle without necessitating alteration in the diameter of the socket. For this purpose, two rings are employed, pierced at any number of points to receive bolts with nuts. One ring is adapted to be slipped on to the spigot end of the pipes to be joined, and the other is pushed along the other pipe to bear against the shoulder formed by its socket in the way known with these joints. The ring arranged to sit on the spigot end is shaped at the part bearing on the pipe so as to form a housing for a triangular or dovetail ring of rubber or other material—this shaping of the ring being formed so that it not only takes away a portion of the ring surface which would bear on the pipe, but also takes a part from the ring surface which would face the socket end of the adjacent pipe. This face of the opposing socket end is inclined so that when the dovetail ring is in position and the pipe ends are being joined, the inclined face of the socket, acting in conjunction with the opposite taper of the shaping of the ring, forces down the triangular ring, so that its base presses tightly around the spigot and makes an effective joint.



Bewlay's Pipe-Joint.

A sectional elevation is given of the upper half of such a pipe joint. The spigot and socket are of ordinary construction. C is the loose ring which is slipped on to the spigot before the pipes are brought together; and D is the securing ring which is slipped along the pipes from the spigot end to the socket. The ring D is shaped on its underside to bear firmly on the shoulder B of the socket. The ring C is cut away from a point on its face to a point on the surface bearing on the spigot. In this space, the triangular or dovetail packing ring E is housed. It has sloping sides of considerable extent and an extensive base, adapted for forming the seal against the spigot. The socket is inclined at its end; and this incline, acting with the oppositely inclined face on the ring C as the pipes are drawn together by the bolt F, forces down the ring E so that its base I presses firmly around the spigot and forms a secure joint.

Securing the Ready Ignitability and Continuity of Combustion of Fixed Carbon Fuels.

THWAITE, B. H., of Great George Street, S.W.

No. 665; Jan. 10, 1907.

This invention relates "to processes, and apparatus therefor, having for their object the removal of the objections and difficulties associated with the employment of coke, anthracite, charcoal, and other fixed carbon fuels, in open household and other fire-grates. The main objections to the use of fixed carbon fuels, is, first, the difficulty in effecting the ignition of such fuels, and, second, in securing the continuity of such combustion when fuel is ignited."

In coke-oven and gas-retort apparatus, the patentee points out, for effecting coal distillation, the object has always been to drive off, or distil off, volatilize, or evaporate all the hydrocarbon contents of the coal, part of which is available for illuminating purposes; the remaining portion condensing out as tar and pitch or oil; the fixed carbon in a spongy form remains as fixed carbon, known as coke. The same difficulty, in a less or greater degree, is characteristic of the fixed carbon fuels, charcoal and anthracite. These fixed carbons are always difficult to ignite compared with coal. The latter fuel contains hydrocarbons, and, on ignition, the hydrocarbons are soon given off, immediately igniting into a flame, and tending to heat the surface of the coke to the state of incandescence at which coke will burn. The continued exudation of the hydrocarbons maintains the combustion of the fixed carbon, and the complete oxidation of the richer hydrocarbons is very difficult to effect. It is this difficulty that constitutes the greatest source of fuel waste, and of smoke production.

This invention is intended to secure for these fixed carbon fuels an approach to, if not the entire inflammability of, the average kinds of household coals. This is secured in two ways. The first one is briefly described as follows: The coke, charcoal, and anthracite are broken into regularly proportioned lumps that will pass through 1½-inch diameter ring, preferably broken by machine. The lumps are introduced into a special steel chamber or vessel, where they are subjected to special treatment in apparatus consisting of a vertical cylinder, with cone-shaped terminations, having an outlet and inlet—the inlet at the top and the outlet at the bottom. The inlet sliding-door forms part of, or is a continuation of, a shoot by which the coke and other fixed carbon to be treated is introduced into the treatment vessel. The broken and uniform lumps are elevated or fed on to the shoot delivery, by which the coke is introduced into the treatment vessel. The structural strength of the treatment vessel is adequate to sustain a vacuum pressure of one atmosphere, and a plenum pressure of several atmospheres.

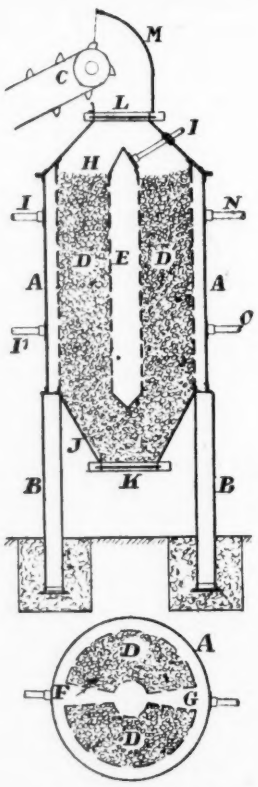
The first operation after the coke is introduced into the vessel is to establish in it a strong vacuum; the inlet and outlet doors being closed and fixed for the purpose. Then the vacuum connection is cut off, and the vapour from any suitable and condensible hydrocarbon, heated to a temperature (say) varying from 400° to 900° Fahr., is allowed to enter the treatment vessel, and the vapour is then immediately absorbed into the pores of the fixed carbon or coke; the introduction of the hydrocarbon vapour being made more complete by the pressure influence. The vapour of the hydrocarbon condenses in the interstices of the fuel on cooling. The excess vapour, after a sufficient period of treatment has been secured, is allowed to escape into a condenser, where its tar condition is restored; it is then available for re-use. After such a time has elapsed as will prevent the escape of the condensed hydrocarbons from the interstices of the fuel, the outlet door at the base of the treatment vessel is opened, and the hydrocarbonized fuel is allowed to fall out.

The period of time of exposure and pressure of the hydrocarbon vapour is so regulated for different kinds of fuels as to secure the adequate degree of ignitability and inflammability of the coke; the pressure of the vacuum and of the plenum being proportionate to the density of the fixed carbon materials to be treated.

The vapour used may be selected from any of the hydrocarbon vapours—such as tar, pitch, or a mixture of both, or astatki, or other petroleum residues remaining after fractional distillation.

The vacuum and compression, *plus* the thermal influence, will secure, it is said, a full vapour saturation of the fixed carbon, coke, anthracite, &c., so that on lighting the fuel the vapour of hydrocarbon will be evolved, and burn on the surface of the coke, which will also be oxidized as is coal.

The "economics of the treatment" described will be understood by the following words of the patentee: Ordinary coal other than anthracite has very varying proportions of hydrocarbons. The more volatile and richer among them are volatilized as soon as the coal is placed on the fire, and may or may not burn. If they do, their thermal efficiency is to a great extent wasted; they are only partially burnt at the best—hence the smoke. These gases are the same as those constituting coal or retort gas; and their approximate role is for illuminating services. To use the gases in any other way constitutes an inexcusable waste, and an offence against natural laws. When the fixed carbon (hydrocarbon-treated materials) have been cooled and dried on their surfaces—and to secure which drying they are passed through a drying cylinder—then the new fuel is ready for use, and will provide a smokeless and sustained (household) fire. The burning of the hydrocarbon will, of course, add to the heat produced by the oxidation of the fixed carbon.



Thwaite's Coke-Making Plant.

The vertical section and plan of the treatment vessel constituting part of the invention consists of a vertical steel or iron vessel A supported on stanchions B. The coke to be treated is lifted by the elevator C and deposited into the treatment vessel. In order to permit the hydrocarbon and condensible vapours to approach and penetrate the coke as uniformly as possible, there is an internal vessel D, made of less diameter than the external one. A central flue E is built up of

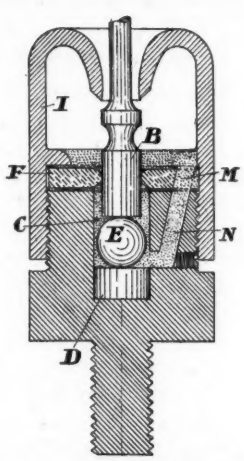
perforated plates, wire netting, or wire gauze, and also partitions F of the same material enclosing spaces G by which the hydrocarbon vapour finds easy access to the coke. The central flue has a conical cap H which constitutes one of the points of entry for the hydrocarbon vapour by means of the inlet pipe I. The base of the vessel consists of an inverted truncated cone J terminating with a sliding door K, the opening of which allows the coke to fall out of the vessel. A sliding door L is provided in the coke introducing hood M, so that a vacuum can be established. The suction effect is applied to the two pipes N and O, equipped with valves, arranged with levers that permit them to be actuated from the ground level. The two sliding doors K and L can also be operated from the ground level. The vessel having been filled with coke, the doors K and L are closed, and the valves of the vacuum pipes N and O are opened, and as perfect a vacuum as practicable is established. Then the valves or pipes N and O are closed and the valve in the tar vapour inlet pipes I and I^1 are opened—allowing the entrance of the tar vapour, which continues to flow until the vacuum is destroyed. The introduction of the tar vapour is continued until a pressure is established. Then the tar vapour inlet is shut off until the pressure gauge shows that the whole of the tar vapour has entered into, and condensed inside the pores of, the coke. The door L is now opened, and the treated coke is allowed to fall from the vessel.

Spindle Bearings for Rotary Fluid-Meters.

THORP, T., of Whitefield, near Manchester.

No. 650; Jan. 10, 1907.

This invention relates to rotary gas and water meters of the kind described in patents No. 20,214 of 1901 and No. 6017 of 1903, and consists in improvements in the bearings for the fan-wheel spindle. The footstep bearings for the spindle in gas-meters have been made as described in patent No. 3140 of 1907, bored out to a larger diameter than the spindle foot, which rested on a ball, and with the spindle held in its position by means of an agate or jewel ring fitting it and secured to the bearing by a nut—the space under the ring being filled with mercury. Such bearings have the disadvantage, the patentee points out, that in the case of water-meters and of gas-meters for imperfectly washed blast-furnace gases, coke-oven gases, and the like, the grit contained therein, or in the water collecting above the jewel, rapidly grinds away and destroys the spindle; while in the case of gas-meters the tarry deposits clog the spindle. The mercury also has to be filled in after the meter is erected in the position it is to occupy. The object of the present invention is to remedy these defects.



Thorp's Spindle Bearing for Rotary Meters.

The bearing shown is bored out to a larger diameter than the spindle end B. Into the bottom of the hole C a hardened steel flat-faced disc D (having the upper surface well polished) is fitted. In the bore above the disc a ball E, of somewhat smaller diameter than the bore, is placed between the disc and the hardened end of the spindle. On the top of the bearing a steel or agate ring F, fitting the spindle, is secured between leather washers by a cap I, of iron or other material unaffected by mercury (such as vitreous material or enamelled copper), screwed upon the bearing body. The cap is preferably cylindrical, and has an internal diameter about equal to that of the bearing body upon which it is screwed; and the sides are turned inwards at the top and bent down—in the manner of a non-spilling inkstand—so as to form an inverted annular cup. The space above the ring communicates through a hole M and a passage N arranged in the body of the bearing with the bore C of the latter.

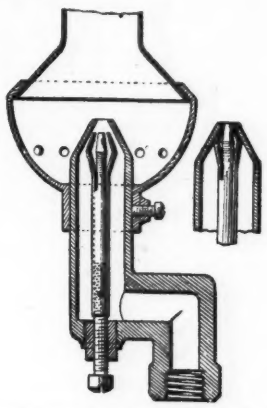
Mercury is filled into the cap, whence it finds its way to the spaces surrounding the bearing-surfaces, so that all the bearing-surfaces are immersed in mercury, and grit, water, and tarry deposits are effectually excluded from it. If the meter is placed on one side, or even upside down, the mercury will be retained in the cap—the inverted annular cup thus formed having a sufficient capacity to retain the whole of the mercury. When placed upright, the mercury flows back upon the top of the ring and through the hole, filling the spaces in the way stated.

Regulators for Gas-Burners.

JOHNSON, C. J., of St. Louis, U.S.A.

No. 2791; Feb. 4, 1907. Date claimed under International Convention, Feb. 5, 1906.

This invention would, the patentee remarks, be "useful" on bunsen burners where it is necessary to introduce a jet (for mixture with air) which can be regulated as to size. It is of the type in which a tubular nipple formed with cross slits and a central hole is adapted to be more or less compressed within a conical nozzle by screwing the nipple up or down. The device "furnishes a solid cylindrical stream of gas, the size of which may be regulated as desired, and from which maximum results can be obtained."



Johnson's Gas-Burner Regulator.

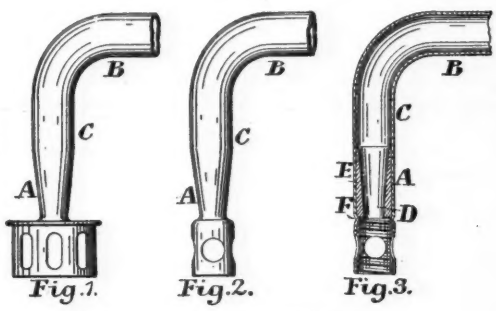
As shown, the tube through which gas is introduced has a conical-shaped end surrounded by a dish-shaped chamber furnished with perforations through which air is supplied. A plug screwed into an elbow of the gas inlet tube protects an opening through which a bar is inserted, which may be raised or lowered by a set-screw. The upper end of the bar is flared, as shown, and cut with slits. The flaring shape at the end is capable of compression, so that when the bar is screwed upward the flanges close, and yet leave a central orifice to allow the exit of a circular jet of gas. Retreating ends of the regulator fit snugly in the inside of the burner cone, so that the jet, whether large or small, is relatively always the same and enters the ignition chambers at the exact centre.

Bunsen Tubes of Inverted Burners.

BRAY, J. W., of Leeds.

No. 8972; April 18, 1907.

The patentee proposes to so arrange and construct the bunsen tube as "to produce a flame of sufficient fierceness to completely fill the ordinary sized mantle, or even a larger one, with the result that a brilliant light is obtained."



Bray's Bunsen Tubes for Inverted Burners.

As shown applied to a bent or curved bunsen tube, the lower portion A of the tube B is tapered; the taper taking place towards the base of the tube or mixing-chamber C—that is to say, the opening into the bunsen tube is restricted at D (fig. 3) and gradually tapered until the diameter of the bunsen tube is reached. The taper may be formed in the tube itself (figs. 1 and 2), or the tube may be of the same diameter throughout (fig. 3), and the taper be formed inside the tube B, by means of a porcelain, metal, or like injector E, increasing in diameter from the mixing-chamber C in an upward direction until the diameter of the tube B is reached. The injector may be held in position by any suitable means; the necking of the tube at F showing one means.

This forming of the bunsen tube into an injector tends to increase the velocity of the gas and air mixture, and produce the result set forth above. The arrangement must not, the patentee points out, be confused with a "Venturian tube," which has hitherto been used in both inverted and upright incandescent gas-burners, though the same or a rather better effect is produced.

Incandescent Gas-Burner.

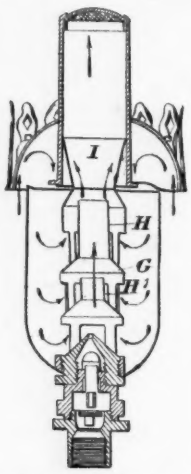
VIEU, R. M., of Paris.

No. 15,544; July 5, 1907. Date claimed under International Convention, Nov. 14, 1906.

This invention has for its object an improved construction of the burner which is said to be the subject of "co-pending application for letters patent No. 15,543 of 1907."

The accompanying illustration shows the improved burner in vertical section. On the gas-nipple is screwed a tube providing two mixing-chambers, constituted of conical parts G and cylindrical parts H H^1, through which successively passes the mixture of air and gas before entering the third chamber I. The air passing through the openings mixes successively with the gas in the two central chambers. The

chamber I is formed by a tube contracted at its base by a stricture formed by making it of double conical shape as shown; and beneath the contracted part are arranged openings for allowing the air to enter the chamber.



Vieu's Incandescent Burner.

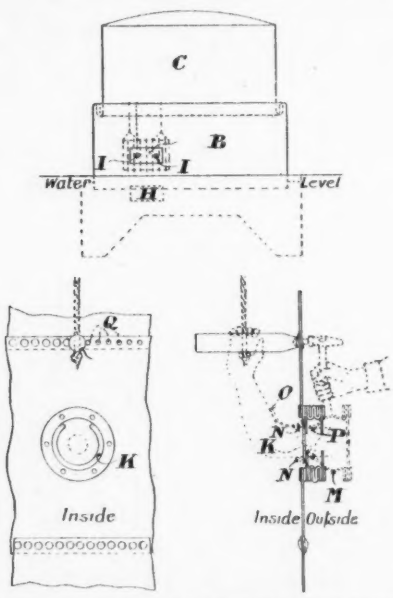
With this improved construction it is possible, the patentee states, without increasing the height or the diameter of the tube, to increase the quantity of air supplied and the power of the burner.

Repairing Gasholders while Inflated with Gas.

DAVIES, W. M., TYSOE, J., and DUNPHY, A. L., all of the South Metropolitan Gas-Works, East Greenwich.

No. 15,555; July 6, 1907.

In modern gasholders as now built (of such large capacities as one million cubic feet and upwards), it is found to be not only a costly process, the patentees remark, to put them out of action when repairs are necessary to the sheeting, but in many cases, and when the town demands for gas vary greatly, it is a very inconvenient and expensive risk to put the gasholder out of action and ventilate the interior so that workmen can safely enter, without danger, to effect the necessary repairs. The object of the invention, therefore, is to enable a plate, or a sheet, or part of a sheet, to be cut out from a holder while the holder is inflated with gas; to remove the plate, still keeping the gasholder in action, and use it as a template for making the new plate; and to fix in place and rivet the new plate to the holder without stopping the use of the holder and without loss or escape of gas. The arrangement was described by Mr. Tysoe in the course of his paper read before the recent meeting of the Southern Association—see *ante*, p. 565.



Davies, Tysoe, and Dunphy's Gasholder Sheet Repairer.

The illustration shows an elevation of a holder (the standards and ties being omitted) showing plate to be repaired or replaced, rubber sheet, and armhole; an inside elevation; and a section of the apparatus, called a "gas-lock," fitted with an automatic flap-valve or rubber to be used in carrying out the invention.

To repair a plate, sheet, or part of a sheet, in a lift B the holder is lowered into the tank until the lift C is uncupped sufficiently to leave space enough below the bottom of the dip-plate to pass a rubber sheet (strengthened with parallel slats if necessary) and suspend it in the ascertained position at the back of the plate to be replaced by ropes passed through holes drilled in the top of the grip plate. The holder is then raised until the rivets in the damaged plate, each in its turn coming within 6 or 8 inches of or near the water level in the tank, are stripped off, and the plate removed while the aperture H is below the water level. The new plate, being marked and drilled according to the old plate, is fitted with one or more armholes I, and gas-locks, consisting of a rubber flap-valve working on a rubber seating K with an aperture in it. A similar rubber sheet, with similar aperture, is attached to an extension bellows M with rubber ribs, into and through which an arm can be thrust stretching the aperture K to N, opening the flap-valve to O, and so making a gas-tight joint around the arm at N and P. The plate is then lowered into its place—being temporarily fastened with tackle bolts by passing the arm through the nearest gas-lock. The rivet holes Q are then temporarily stopped by pegging with wood or clay as the holder rises high enough to enable the final riveting to be performed.

For completing the final riveting with ease and safety, a hole is drilled in the grip plate, through which is passed a rope, one end of which is lowered inside the holder and brought through the gas-lock on the plate which it is intended to rivet. A dolly is fastened to this rope, and is then passed through the gas-lock and left suspended inside the holder. The arm is then withdrawn and again inserted through the gas-lock with a rivet, which is placed in the rivet hole, and the dolly is then held in position on the rivet head until the point is riveted and finished on the outside. The other end of the rope is brought down outside, and the dolly is supported and raised or lowered as required.

In withdrawing the arm from time to time during the riveting, the flap-valve closes automatically and no gas is lost in any appreciable quantity. On completing the riveting, the flap-valve with the gas-lock is taken off and the armhole covered by a blank plate fitted with set-screws or ordinary bolts and nuts – any loss of gas during this operation being prevented by the rubber safety sheet which is afterwards drawn up and removed through the lute when the holder has been lowered sufficiently for the purpose and repairs completed.

In the case of small patches, it is unnecessary to lower the holder in order to seal the aperture; the safety rubber sheet being amply sufficient to prevent any loss of gas during the whole of the operations of cutting out and refixing the new patch.

APPLICATIONS FOR LETTERS PATENT.

25,479.—ARMOUR, L. H., "Manufacture of gas from coal." Nov. 18.
25,521.—GLOVER, S., and WEST, J., "Outlet-doors for vertical retort discharging apparatus." Nov. 18.
25,572.—BLANCHARD, G. B., HARDY, C. C., and BENJAMIN, C., "Joining of pipes." Nov. 19.
25,578.—LEA, J. P., "Water level indicators." Nov. 19.
25,583.—WATSON, R. C., and PORTER, W. F., "Anti-vibration appliances." Nov. 19.
25,637.—JULIUS PINTSCH ACT.-GES., "Carriers for mantles for railway lamps." Nov. 19.
25,638.—HUMPHREY, H. A., "Raising liquids." Nov. 19.
25,657.—ROBIN, J. T., "Mantles." A communication from S. Salomon. Nov. 19.
25,745.—LAUCKHARDT, V., "Joints for pipes." Nov. 20.
25,824.—CLARK, H. N., "Gas control cocks." Nov. 21.
25,826.—PINTSCH'S PATENT LIGHTING COMPANY, LTD., "Gas-beacons." A communication from Julius Pintsch Act.-Ges. Nov. 21.
25,836.—MIEVILLE, M. F., "Carburetted air." Nov. 21.
25,846.—STEWART, J. M., and RENDALL, A. G., "Electrical gas lighting and extinguishing device." Nov. 22.
25,874.—ROWLANDS, P. O., "Burners." Nov. 22.
25,896.—LEWIS, D., and BRIGGS, M., "Suction gas producer plant." Nov. 22.
25,928.—ADAMS, M. J., "Acetylene apparatus." Nov. 22.
25,936.—SOUTHALL, H. W., and WYNN, F. V., "Injector nipples for incandescent burners." Nov. 23.
25,938.—PARKER, G. J. C., "Gas-engines." Nov. 23.
26,013.—PFEIL, P., "Hand pump for cleaning pipe-conduits, particularly those employed for gas-lamps and in the house." Nov. 23.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Burnt Spent Oxide for Gas Purification.

SIR,—Mr. William King's letter in your issue of the 26th inst. is a very interesting addition to the information previously published on the subject of the use of burnt spent oxide in the purification of coal gas, and makes it abundantly clear that I cannot claim to be first to have successfully used this material for such purpose. It is remarkable that during all these years so much valuable material should have been wasted. I have presumptive evidence that even the late Mr. F. C. Hills, who must have known what was done at Liverpool, regarded it as a waste product. Some years ago, the South Metropolitan Gas Company purchased the land on which stood the old chemical works of Messrs. F. C. Hills and Co. On erecting new plant thereon, I came across very large quantities of burnt oxide in excavating for foundations; and there were big mounds of the material deposited in different directions.

I was much interested in your remarks in the same number of the "JOURNAL" in which you were good enough to allude in appreciative terms to a suggestion made by me some years ago on the subject of the formation of a Gas-Works Foremen's Association. The passing of years has but served to strengthen the opinion I then held as to the value such an Association would be, not alone to the members themselves, but to the gas industry generally; and I feel sure that any movement in that direction would receive the support of gas engineers and managers generally.

East Greenwich, Nov. 30, 1907. JOSEPH TYSOE.

Price of Gas in Sheffield.

SIR,—The figures quoted by Mr. Hanbury Thomas at a meeting reported in your issue of the 19th of November, to the effect that during a period of twenty years the price of gas had been reduced by 10d. per 1000 cubic feet in Sheffield compared with only 3d. in certain other towns, are somewhat startling and misleading. An examination of "Field's Analysis" for 1887 and 1906 show how this saving at Sheffield has been effected. Here are the results:

	Pence per 1000 Cubic Feet Sold.
Reduction in cost of coal	5·17
,, rates and taxes	0·60
,, cost of working	0·61
,, charges for capital	3·54
Total	9·92

As the Sheffield Company charge meter and stove rents, and certain towns have abolished these charges during the period under review, a fair comparison can only be obtained by taking the total receipts from gas and meter and stove rents. I have compiled the following table, which is comprised of works appearing in "Field's Analysis" for 1887 and 1906:

Receipts from Gas and Meter and Stove Rents per 1000 *Cubic Feet of Gas Sold.*

Town.	1887. s. d.		1906. s. d.		Reduction in Receipts. d.
1	2 2·85	..	2 0·40	..	2·45
2	2 9·15	..	2 7·26	..	1·89
3	2 5·65	..	2 4·59	..	1·06
4	2 8·87	..	2 3·72	..	5·15
5	2 4·88	..	2 7·28	(increase)	2·40
6	2 6·07	..	2 1·15	..	4·92
7	3 3·04	..	2 3·35	..	11·69
8	2 4·60	..	2 0·54	..	4·06
9	1 9·71	..	1 10·89	(increase)	1·18
10 (Sheffield)	2 2·71	..	1 5·63	..	9·08

It will be seen that Sheffield must, therefore, yield the palm to town No. 7 for the greatest reduction in the price of gas, at any rate up to March last.

Sheffield gas consumers are now obtaining their gas at a price more proportionate to the advantages of their geographical position, and, all things considered, relatively as cheap as the supply to the other towns cited. As a result of Mr. Thomas's comparison, gas engineers and managers may justly claim that their works, with, perhaps, one or two notable exceptions, were nearly or equally as well managed twenty years ago as now; and that there was at least one works badly managed in 1887—viz., those of the city on the Don.

GAS MAN.

Nov. 26, 1907.

Mr. Dugald Clerk's Remarks on Gas-Heating Apparatus.

SIR,—In his interesting and suggestive Presidential Address to the Society of British Gas Industries, which appeared in your last issue, Mr. Dugald Clerk made certain comments regarding gas-heating apparatus to which I endeavoured to reply in brief impromptu fashion, at the time, under the disadvantage of not having seen the address before it was delivered. I now venture to supplement the remarks which I then made.

Mr. Dugald Clerk no doubt felt, and justly so, that no criticism can be more appropriate or more useful to the members of the Society than that which comes from within that body itself; and I am confident the Society will always listen with respect to any pronouncement from so eminent an authority on gas matters as its present President. I, for one, as a maker of gas-heating apparatus, shall always welcome (as I believe all my *confrères* in the same class of manufacture will do) every well-grounded criticism of present-day appliances. It is manifestly the common interest of gas makers and gas-stove manufacturers that these articles should be as perfect as Science and Practice can make them. But if criticism is to promote this end, it must be based on accurate data, and it must be "up-to-date;" otherwise it becomes more dangerous than helpful. Unhappily, it is evident from the address itself, and also from Mr. Dugald Clerk's admission in his subsequent remarks, that he was not speaking from any recent personal investigation, and that he was not familiar with the great progress made of late in gas-heating appliances as indicated by exhaustive tests reported from time to time in your columns and elsewhere. It would be most unfortunate, in the interests of the gas industry as a whole, if the great authority—personal and official—of the speaker were to seem to lend colour to the impression that his criticism was applicable, in any substantial degree, to the best types of modern gas-fire or flueless stoves; and I believe Mr. Dugald Clerk would himself be the first to deprecate such a result.

So poisonous a gas as carbon monoxide deserves the worst that Mr. Dugald Clerk can say of it; but neither the makers who design gas-heaters nor the gas engineers who distribute them deserve his strictures. As a matter of fact, perhaps no one of the essential conditions of gas heating has been dealt with more strenuously or successfully than the elimination of carbon monoxide. So long ago as 1902, Dr. Thorpe, the Chief Chemist in the Government Laboratory, at the request of Dr. Legge, H.M. Medical Inspector of Factories, tested for carbonic oxide several gas-stoves of different makes; and in two cases out of three he found only traces ranging from 0·001 to 0·007 per cent. In a further trial, imitating the conditions in a small ill-ventilated room, the results were traces of carbon monoxide ranging from *nil* up to 0·003 per cent. One of these two stoves was of the old condensing radiator type, having an open fire, in which the *flames impinged on fire-clay fuel;* and it had *no flue*. Dr. Thorpe remarked that in the two stoves referred to the amount of carbon monoxide was too small to be detected by the well-known carbonyl-hæmoglobin test. Dr. Legge, in commenting on these tests, said: "Carbon monoxide is usually present in such small proportion that, with proper ventilation, it could not reach the percentage which has been found to cause mischief." Thus by 1902 several gas-stove makers had produced fires in which the combustion was so near to absolute perfection that the carbonic oxide had been reduced to a negligible, if not a vanishing, quantity.

How much farther have they progressed in the five years since then? For answer, let me refer to the painstaking tests made by Mr. J. H. Brearley, of Longwood, as set forth in his invaluable paper read before the Institution of Gas Engineers in Dublin last June. Mr. Brearley finding, like Dr. Thorpe, that the Haldane blood test was useless, owing to the minuteness of the traces of carbonic oxide to be looked for, had recourse to the more minute and elaborate tests with iodine pentoxide and carbon tetrachloride described in his paper. He made 24 tests for carbon monoxide, under most searching conditions, with five or six different makes of stove, all of them having radiating material impinged on by the flame; and in only five tests out of the 24 did he find any trace of carbonic oxide given off by the gas-fires, otherwise than through the flue, while in none of these did the trace exceed 0·35 of one part in 100,000 parts—or, in other words, 0·00035 per cent., as compared with Dr. Thorpe's 0·003 per cent. in 1902. In all the other 19 tests he found no trace whatever of carbon monoxide. In the waste products carried off by the stove-flues, he found only a very little carbonic oxide in the majority of cases, well under 1 part in 100,000 parts, showing that, not only did these stoves send no carbonic oxide into the room, but that the combustion was so nearly perfect that scarcely any carbonic oxide was produced at all.

Mr. Dugald Clerk speaks of the reaction of the human subject to carbonic oxide as an unfailing test, and refers to his own sensitiveness to this test. But I am sure he will willingly admit the greater value of scientific results like those of Dr. Thorpe and Mr. Brearley, to any rough-and-ready test in which he himself or anyone else is the *corpus vilis*, and in which other conditions, quite unsuspected, may affect the result.

It is true that, when a cold body is impinged upon by the flame, perfect combustion is interfered with and carbonic oxide results; but in any modern gas-fire of good design, these conditions disappear as soon as the radiating material has become heated up, while in well-designed modern flueless gas-stoves—as, for example, the gas-steam radiator types—the construction is such that the flames are free from impinging on any solid body, and conditions are therefore highly favourable to perfect combustion.

H. JAMES YATES.

Essex Works, Birmingham, Nov. 29, 1907.

PARLIAMENTARY INTELLIGENCE.

NOTICES GIVEN FOR BILLS (SESSION 1908) RELATING TO GAS AND WATER SUPPLY.

The following notices for Bills have been given, in addition to those published in the "JOURNAL" last week (p. 648).

Briton Ferry Urban District Council.—The Briton Ferry Urban District Council purpose applying for power to extend their area by including part of the borough of Aberavon; and they will seek authority to supply water in the enlarged district, as well as in Baglan Lower, in the rural district of Neath, which parish or hamlet will be excluded from the limits of supply of the Neath Corporation. The Bill to be promoted will contain provisions in regard to the maintenance of the water-works, the taking of water and its protection from pollution, the levying of rates and charges, &c. Further money powers will be required.

Burnley Corporation.—Application will be made by the Burnley Corporation for authority to construct a reservoir in the township or parish of Worsthorne-with-Hurstwood, two catchwaters, five aqueducts, two road and footpath diversions, and other works; to purchase lands within the drainage areas of the Thornden Clough or Hurstwood Brook and Shedden Clough, and collect and impound the waters of these streams; and to make agreements with owners, &c., of lands in regard to drainage and the protection of waters and works from pollution. The Bill to be promoted will contain the usual provisions in regard to the supply of water, further provisions relative to the supply of gas, and regulations for the sale of coke. It is proposed to ask for an extension of the borough boundaries, and consequently of the limits of both gas and water supply, so that these shall include the parish of Brunshaw and part of the township or parish of Habergham Eaves. More money will be required.

Bury and District Joint Water Board.—The Bury and District Joint Water Board will apply for an extension of time for the compulsory purchase of lands and for the completion of works authorized by their Act of 1903. The works in question are the New Hall reservoir and the two Scout Moor reservoirs, with the auxiliary tunnels, pipe-lines, &c. Borrowing powers will be required.

Conway and Colwyn Bay Joint Water Board.—It is the intention of the Board to apply for sanction to, and confirmation of, their proceedings with reference to the acquisition of lands and the construction of their existing works, and for authority to divert water from Lake Cowlyd and the Afon Ddu River. In the Bill to be promoted, provisions will be inserted for the prevention of the pollution of water, the supply of fittings, and the charges for both. Authority will be sought to raise more money.

Glyncorrwg Urban District Council.—In a Bill of which notice has been given by the Council, provisions will be included for the construction of water-works, consisting of a storage reservoir on the River Corrwg, and an aqueduct or pipe-line from it into Glyncorrwg. Authority will be sought to abstract water from the above-named river and the Nant-y-Derwydd Brook, make the necessary arrangements to protect the water from pollution, supply it in bulk, and levy rates and charges. Borrowing powers will be required.

Greystones Gas.—Application will be made for power to incorporate a Company to construct works, manufacture gas, and supply it in

various places in the rural district of Rathdown No. 2, in the county of Wicklow. The Bill to be promoted will contain the usual provisions in regard to gas, and will include authority to apply for power to supply electricity.

Holderness Water.—Authority will be sought for the incorporation of a Company for the construction of works, and the supply of water in a number of urban and rural districts, parishes, townships, and places in the East Riding of the county of York. The works will consist of a well and pumping-station in the parish of Lockington, in the rural district of Beverley, a service reservoir in the parish of Holme-on-the-Wolds, two conduits or pipe-lines, and a water-tower; and permission will be asked to purchase the existing water-works of the Hornsea Urban District Council, or some part of them. The Bill to be promoted will contain the usual provisions in regard to water supply, and will define the capital and borrowing powers of the Company.

Keighley Corporation.—The Keighley Corporation have notified their intention to apply for power to purchase or acquire by agreement additional lands in and near the appropriated drainage areas of the Corporation, particularly 120 acres in the township of Haworth, in the West Riding of the county of York, and also the Calversyke, Highfield, and Lower Castle Hill reservoirs, at present held under lease. The Corporation require an extension of the time specified by various Acts for the construction and completion of the New Bully Trees and Lower Laithe reservoirs and other works. They will ask for authority to alter their existing rates, rents, and charges for water supply, and make provision for any deficiency in the water undertaking being made up out of the general district rate of the borough; and they will seek to be enabled to enter into agreements with the Bradford Corporation for the supply of water in bulk by the latter. The Bill to be promoted will contain further provisions in regard to the Corporation's electricity and gas undertakings, and others sanctioning the raising of more money.

Leicester Corporation.—Parliamentary sanction will be sought for an extension of the limits for the supply of gas and water by the Leicester Corporation, so as to include a number of parishes, townships, and places in the county of Leicester. It is proposed to make further provisions in regard to testing the illuminating power or quality of the gas, and the apparatus to be employed for the purpose. Authority will be asked for altering and increasing the water-rates, and for making provision for their recovery from ordinary debtors and in cases of bankruptcy. The Corporation wish to acquire sporting rights over and adjacent to reservoirs. Borrowing powers will be required.

Liverpool Corporation.—In a General Powers Bill of which the Liverpool Corporation have given notice, they will ask for authority to alter the charges for water outside the city, and for the repeal of the existing obligation to supply water in St. Helens, Widnes, and Warrington. The Corporation wish to make provision that the water need not be laid on under pressure, or supplied to an elevation greater than can be afforded by gravitation from their works, or such other elevation as may be prescribed; and they will ask for power to stop up certain footpaths on the Rivington watershed.

Llanelly Rural and Burry Port Water Board.—Application will be made for authority to constitute and incorporate a Water Board for the Rural District of Llanelly and the Urban District of Burry Port, in the county of Carmarthen; and it is proposed to include on the Board representatives of the Ammanford Urban District Council and the Llandilofawr Rural District Council. The Board will ask for power to construct water-works, consisting of an intake on the River Loughor, a compensation reservoir on the same river, a service reservoir in the parish of Pembrey, another in the parish of Llennon, a pumping-station in that parish, and several conduits or pipe-lines. The limits of supply will be defined in the Bill, in which provision will be made for the repeal of part of the Llanelly Local Board Water-Works Act, 1865, and the rescission of an indenture made between the Llanelly Urban and Rural District Councils. The Bill will also contain provisions relating to compensation water, and also as to the apportionment of that which is available, the supply of it in bulk, the making of bye-laws for preventing pollution and waste, the contribution to the expenses by the constituent authorities, and the settlement of any questions that may arise. The necessary money powers will be required.

Margate Corporation.—In a General Powers Bill to be promoted by the Margate Corporation, they will apply for authority to lay down communication-pipes on behalf of owners and occupiers, repair such pipes, and recover the cost from the parties. They will also seek permission to supply sea water for public and private purposes, and to provide the necessary buildings, machinery, and apparatus for carrying this out.

Ravensthorpe Urban District Council.—Further powers will be sought next session by the Ravensthorpe Urban District Council with respect to their water undertaking. They wish to have their limits of supply enlarged to the extent to be defined in the Bill, and to be authorized to make bye-laws to prevent waste, and to sell or let on hire meters and fittings. Borrowing and other powers will be asked for.

Rhymney and Aber Valleys Gas and Water.—Application will be made by the Rhymney and Aber Valleys Gas and Water Company for the revival and extension of powers for the construction and completion of the reservoir and the auxiliary aqueducts or pipe-lines and filter-beds authorized by their Acts of 1892 and 1898, also for authority to construct additional works for utilizing the water of two springs in the parish of Llanfabon, in the county of Glamorgan. It is likewise proposed to construct additional gas-works at Caerphilly, and to manufacture, store, and sell gas and residual products. The existing share and loan capital is to be consolidated and rearranged, and permission to raise more will be applied for. It is proposed to revive the powers for the purchase of land and the construction of works contained in the Rhymney Valley Gas and Water Act, 1892, which were transferred to the Company under the Rhymney and Aber Valleys Gas and Water Act, 1898. In the Bill to be promoted, provision will be made for the reduction of the illuminating power of the gas, so that in future it "shall not exceed 12 candles," and for the inspection and examination of meters and fittings.

Slough Urban District Council.—Application will be made by the Council for authority to acquire the undertaking of the Slough Water Company, maintain existing works, and supply water within the Company's limits. Confirmation will be sought of an agreement entered into between the Council and the Company for the purchase; and the necessary borrowing powers will be applied for.

South Lincolnshire Water.—The South Lincolnshire Water Company will apply for an extension of their limits of supply, as defined by their Act of last year, so as to include therein the rural districts of Bourne, Branston, Claypole, Grantham, Sleaford, and Spalding, and the urban districts of Bourne and Bracebridge, all in the county of Lincoln; and also for authority to purchase the undertaking of the South Lincolnshire (Fen) Water Company. Additional capital will be required, as well as the amendment of the South Lincolnshire Water Act, 1906, and other Acts and Orders.

Stockport Corporation.—In a General Powers Bill to be promoted by the Stockport Corporation, provisions will be included to extend the time for the purchase of certain lands and easements under the Stockport Corporation Water Act, 1901.

Wolverhampton Corporation.—The Corporation of Wolverhampton have given notice of a Bill which will contain provisions in regard to the recovery of water-rents in the case of small houses, the supply of water to trade premises, and the prevention of waste.

PROVISIONAL ORDER APPLICATIONS (SESSION 1908).

Board of Trade, under Gas and Water Works Facilities Act, 1870.

Brough Water.—Authority will be sought for the construction of water-works, and for the supply of water in the parishes, or parts of the parishes, of Elloughton-with-Brough and Brantingham, in the East Riding of the county of York, together with the incidental financial and other powers.

Burgess Hill Water.—The Burgess Hill Water Company will apply for an alteration and extension of their limits of supply so as to include the parishes of Albourne, Twineham, Westmeston, and parts of the Standean Estate in the parish of Wivelsfield.

Caldicot and District Gas.—The Caldicot and District Gas, Light, and Coke Company, Limited, will apply for authority to construct and maintain gas-works, and supply gas to the parish of Caldicot and other places in the county of Monmouth, under the usual powers; and also to regulate their existing capital and raise more.

Earby and Thornton Gas.—Application will be made by the Earby and Thornton Gas and Lighting Company, Limited, for authority to raise additional capital.

East Hull Gas.—The East Hull Gas Company will apply for power to make further provision with respect to the method of testing their gas; and for this purpose it is proposed to amend the Sutton, Southcoates, and Drypool Gas Act, 1867, the East Hull Gas Act, 1906, and any other Act or Order relating to the Company.

Rainford Gas.—Application will be made by a Company to be registered or by certain persons to be named, for power to construct works for the manufacture and storage of gas and the conversion of residual products, and to supply gas within the parish and urban district of Rainford, in Lancashire. Authority will be asked for the employment of the existing funds for the purposes of the intended Order, and for making provision for increasing their capital and borrowing powers.

Rothwell Gas.—The Rothwell Gas Company will apply for authority to construct works for the manufacture of gas and the conversion of residual products, and also to erect plant and store gas on a plot of land to the east of the existing works at Rothwell. They wish to be empowered to apply to the purposes of the Order the capital they have already raised, or have the right to raise, under their Act of 1882 and their Orders of 1895 and 1902.

Sevenoaks Water.—The Sevenoaks Water Company will apply for power to raise additional capital.

Stourbridge Water.—The Stourbridge Water-Works Company, Limited, will apply for power to raise additional capital, extend their limits of supply so as to include the parishes of Belbroughton and Broome, in the county of Worcester, and acquire more land.

Tenterden and District Gas.—The Tenterden and District Gas Company, Limited, will seek authority for the maintenance and continuance of their works, and the supply of gas in the borough of Tenterden as well as in High Halden and Rolvenden. In the draft Order, provision will be made in regard to the capital and borrowing powers of the Company, the amount of their dividend and interest, and the formation and application of reserve and renewal funds. Power will be required for the acquisition of lands.

Woolmer and District Gas.—Authority will be sought by Mr. F. W. Talbot to construct and maintain gas-works at Headley, and supply gas within the parishes of Headley, Kingsley, and Selborne, in the rural district of Alton, in the county of Southampton. The applicant will ask for authority to raise capital by shares or on loan.

Local Government Board, under the Public Health Act, 1875, and the Gas and Water Works Facilities Act, 1870.

Sutton-in-Ashfield Urban District Gas.—Application will be made by the Sutton-in-Ashfield Urban District Council for authority to acquire additional lands for the purposes of their gas undertaking, and to erect thereon works for the manufacture of gas and the conversion of residual products. They wish to be enabled to apply for the purpose and for restoring the district fund the money arising from the sale of a portion of their undertaking to the Kirkby-in-Ashfield Urban District Council; and they will ask for further powers in regard to gas supply, including its sale in bulk beyond their limits.

Secretary for Scotland, under the Private Legislation Procedure (Scotland) Act, 1899.

Falkirk and District Water.—The Falkirk and Larbert Water Trustees will apply for power to construct new works, consisting of three conduits, and will ask to have revived the powers conferred by their Act

of 1900 in regard to a reservoir, filter-beds, and other works, and to the compulsory taking of lands for a portion of them. It is proposed to alter and increase the rates and charges for the supply of water by measure. More money will be required.

Lanark Corporation.—Application will be made by the Lanark Corporation for an extension of the borough boundaries, and for the inclusion of the annexed district within the water area of the Town Council.

Lanarkshire (Middle Ward District) Water.—The District Committee of the Middle Ward of the county of Lanark require power to construct additional water-works, consisting of an enlargement of the existing reservoir in the parish of Avondale, a service reservoir in the parish of Carmunnock, and five aqueducts or pipe-lines. The Committee will ask for an extension of time for the completion of the Glengavel reservoir, and for the repeal of the powers of the Renfrewshire County Authorities to supply water in Lanarkshire under the Renfrewshire Upper District (Eastwood and Mearns) Water Act, 1907, and the Acts incorporated therewith. It is proposed to have the authorities' pipes transferred to the Lanarkshire County Council and the District Committee, subject to the payment of compensation, and to extend the limits of supply. Provision will be made for entering into agreements with other authorities for combination and for other objects; but these authorities are to be prohibited from supplying water within the extended limits. The necessary borrowing powers will be applied for.

Motherwell Burgh Extension.—The Motherwell Town Council wish to extend the limits of the borough, and to include the added area within the compulsory limits of water supply. The proposed Order will contain various provisions with regard to water supply.

St. Andrews Water.—The St. Andrews Town Council will apply for authority to provide a new supply of water for the town and district, and construct a reservoir on the Dunino Burn and various other works. The limits of supply are to be defined and extended, and power will be sought to sell water by meter in bulk both within and beyond them, as well as to make provision for the prevention of waste. The necessary borrowing powers will be included in the Order.

Troon (Loch Bradan) Water.—The Troon Town Council will apply for power to construct additional water-works, renew and improve those now existing, and abstract waters from Loch Bradan and Loch Lure. The new works comprise an embankment or dam for the purpose of raising the waters of the two lochs, three conduits or pipe-lines, and an access road. The Order will contain provisions in regard to the supply of compensation water, fittings, &c., and the borrowing of the necessary money.

Wishaw Burgh (Gas).—In an Order to be applied for by the Wishaw Town Council, they will ask for power to agree with any local or lighting authority, or any other person, beyond the burgh for the supply of gas, and to lay down the necessary mains and pipes (subject to previous consent). The Council wish for sanction to the use of their existing funds for the purpose, and they will apply for more money.

LEGAL INTELLIGENCE.

COUNTY OF LONDON QUARTER SESSIONS.

SESSIONS HOUSE, CLERKENWELL.—Thursday, Oct. 31.

(*Before Mr.* R. LOVELAND LOVELAND, K.C., *Chairman, and a Bench of Justices.*)

Metropolitan Water Board v. Assessment Committee of the City of London Union.

The earlier proceedings in connection with the appeal by the Metropolitan Water Board against the assessments by the Assessment Committee of the City of London Union in respect of 101 of the 114 parishes contained in the Union, have been reported in the "JOURNAL," pp. 503, 579, and 650.

Mr. DANCKWERTS, K.C., Mr. HORACE AVORY, K.C., and Mr. BOYDELL HOUGHTON (instructed by Mr. Walter Moon) appeared for the Water Board. The Counsel for the City of London Union were Mr. BALFOUR BROWNE, K.C., Sir EDWARD BOYLE, Bart., K.C., M.P., and Mr. WALTER C. RYDE (instructed by Messrs. James White and Leonard). Mr. BALFOUR BROWNE and Mr. WALTER RYDE appeared on behalf of the Greenwich Union; Mr. W. C. RYDE, Mr. COX SINCLAIR, and Mr. BICKMORE, for the Woolwich Union; Mr. CUNNINGHAM GLEN and Mr. A. BETHUNE, for the Holborn Union; Mr. MORTEN and Mr. SAUNDERS, for the Borough of Islington; and Mr. COURTHOPE MUNROE, for the Borough of St. Pancras.

Mr. *William H. Elwell*, examined by Mr. BOYDELL HOUGHTON, said he had made valuations of the whole undertaking on the basis of receipts and expenditure as shown by the Board's accounts, and on the capital value basis. The figures of the latter were, however, necessarily the same as Mr. Ryde's; and according to them, the gross estimated rental of the 101 parishes was £6226, the rateable value £4981. In the valuation based on the accounts for the year to March, 1906, the gross receipts were £2,759,753, and the working expenses £713,590. This made the net receipts, *plus* rates, £2,046,163, deducting from which the occupier's share £220,780 left a gross estimated rental, *plus* rates, of £1,825,383. Taking from this statutable deductions £218,000, made the rateable value, *plus* rates, £1,607,383; and deducting average rates at 6s. 9d. in the pound (£405,601), left the net rateable value of the entire undertaking £1,201,782. For the purpose of dividing the amount into the separate unions or parishes, the following was the formula: Rateable value, *plus* rates, £1,607,383. Rateable value of indirectly productive properties, £788,000, and rates thereon at 6s. 9d. in the pound, £1,053,950. Rateable value of directly productive properties, *plus* rates, £553,433, equal to 20·05 per cent. on the gross receipts. The gross water-rentals in the 101 parishes amounted to £144,515, and the rateable value, *plus* rates, was 20·05 per cent., or £28,975. Deduct rates at 7s. in the pound, £7512, and the rateable value of the directly productive portion was £21,463. Add the rateable value of the indirectly productive portion, as in appellants' case, £1748, and there was a total rateable value in the parishes of £23,211. Add statutables (one-fourth), £5801, and the gross estimated rental in the parishes was £29,012. Witness said he had taken the occupier's share at 8 per cent. on the gross receipts, which he thought was fair. He had usually put 10 per cent., both when acting for parishes or unions and when acting for water companies or boards; the reason being that in his estimation the 17½ per cent. on any capital that one could show would not give an adequate remuneration to the tenant. He thought his figure for the gross estimated rental for the parishes, £29,012, was the same as Mr. Ryde's. As to the capital value basis, witness's gross estimated rental was £6226; while Mr. Ryde arrived at a gross value of £2561. Witness divided in proportion with the total gross receipts; whereas Mr. Ryde took the capital value of the mains in the City. His valuation on the accounts was practically the same as Mr. Ryde's; but it was worked out independently of him.

Mr. *F. C. Ryde*, re-called and further examined by Mr. BOYDELL HOUGHTON, said he made a detailed valuation of the land at the works; and the figure he arrived at (which was used by every engineer who had been called) was £1,278,342. As to the mains, it seemed essential that some difference should be made between those which were laid under ordinary roads and those which were placed under expensive paving; and as the Board's area was so very extensive—going right out into the country—there would naturally be a large proportion of the roads not paved, though at the same time in London the majority of the mains would undoubtedly be under paved roads, The conclusion he came to in consultation with Mr. Bryan was that it would be impossible to find out the exact length of mains laid under different kinds of roads; and it seemed to him that the best solution of the difficulty would be to assume that all the roads in the County of London were paved, and all those outside unpaved. He knew, of course, that this would not be strictly accurate; but he was satisfied in his own mind that substantial justice was done by it. Anywhere in London the roads would be considered as paved, in taking particular parishes; so that the method could not possibly work unfairly so far as the City was concerned.

Cross-examined by Mr. BALFOUR BROWNE: There were various classes of roads under which the mains were placed; and he did not know the length of main under each. The figures he put on to the mains to arrive at the value were, however, the actual prices which the Board were now paying under contract for laying the mains. From a tenant's point of view, the value of an old pipe was the same as of a new one. He did not mind whether the landlord had to take it up next year or next month. It did not matter to him, so long as it did not waste water. As to the land, the value put upon it was for water-works purposes; it would frequently be worth very much more for building. He found that his values were very close to the assessments, wherever the assessments were to be obtained; but there were very few cases in which there were separate assessments at all. He maintained that the original cost of the land had nothing whatever to do with the question.

Mr. BALFOUR BROWNE said the test of the value of the land was what was paid for it; and

Sir EDWARD BOYLE asked the Court to make an order for the production of the necessary documents to enable the respondents to ascertain this.

Mr. HORACE AVORY pointed out that the deeds under which some of the land was purchased were in the hands of the original Company; and if an order was made, it would have to be on a party not now before the Court.

The CHAIRMAN said they could not make the order.

Witness was then cross-examined by Mr. CUNNINGHAM GLEN, and said he had not valued any land in Holborn. Pentonville reservoir he was sure was not in Holborn; and the borough that it was in would be very sorry to have their land valued at the price that had been paid for it. It being stated that Claremont Square and New River Head were in the Finsbury part of the Holborn Union, witness said he had put £10,000 on the land at Claremont Square—1 acre 2 roods 27 poles. New River Head was placed at £36,438 for 7 acres 1 rood 6 poles. This included the whole of the property there. Undoubtedly the water at New River Head was used for the City.

Mr. *W. B. Bryan*, re-called and further examined by Mr. HORACE AVORY, as to the suggestion that a number of filters and reservoirs had been valued which were not really in use or necessary now, said that practically the whole of them were in full use, though, of course, there was a margin to allow of cleaning, &c. That there were no more in existence than were necessary for the purposes of the undertaking was proved by the fact that they were being added to at the present moment. Questioned as to how he had arrived at the prices which had been given for laying the mains, witness said wood, granite, or asphalt laid on a thick bed of concrete was taken as the most expensive kind; while the other was reckoned as ordinary macadam. No doubt there were many roads in the County of London which were not paved with wood, &c.; on the other hand, there were very many miles outside which were so paved—especially in the tramway districts. In addition to this, the putting down of tramways involved extra expense in laying mains. In the last four or five years this extra expenditure had been considerable; duplicate mains being laid so as to avoid, in case a communication-pipe needed repairing, the great cost of going underneath the tramways. Roads which formerly had only one service-main now in a great many instances had two—one on either side of the tramway.

Cross-examined by Mr. BALFOUR BROWNE: Unfortunately, the Water Board were not repaid this extra expense. There was the West Ham case, which was given against the East London Water Company and the West Ham Gas Company.* Since then there had been a compromise; and in some cases the Board had received one-half the cost of the new main. There was a provision in the Tramways Act of 1870

* See "JOURNAL," Vol. LXXXVII., pp. 410, 480.

that any extra expense they were put to by reason of the tramway coming in should be paid. He could not give the measurements of the mains under wood paving, &c., and ordinary macadam.

In cross-examination by Mr. CUNNINGHAM GLEN, witness said if granite paving were laid on an ordinary hard-core bottom, naturally it would cost considerably less than if laid upon 6 inches of concrete; but it had been the practice for some years, in the case of streets with moderate traffic, to lay it on concrete. The addition of concrete would certainly put 2s. or 3s. per square yard on the price.

Mr. HORACE AVORY, having put in tables showing the agreed statement of the gross receipts in the various parishes, and the lengths of indirectly productive mains in the City of London Union, announced that this was the case for the appellants.

THE CASE FOR THE RESPONDENTS.

Mr. BALFOUR BROWNE, in opening the case for the respondents, said at the previous quinquennial the rateable value for the City of London parishes was agreed at £45,087; and the rating to-day was £56,080, or £55,108 for the 101 parishes. Now the Water Board came and told the Court that the real rateable value taken upon one hypothesis was £2049, or taken upon the profits £32,277. The latter was the amount in the case, though, of course, the calculations of different witnesses varied. What had happened to lessen the rateable value? Absolutely nothing. All that had occurred was that the receipts in the City had greatly increased, which instead of reducing the rateable value ought to raise it. The duty of the Court and of the Assessment Committee was still to arrive at the rent which a hypothetical tenant would have to pay. Could it make any difference that the hypothetical landlord had changed? None whatever. This extraordinary change in rateable value was not brought about by any fact, but by a manipulation of figures—and figures which it was impossible for the respondents to check. The Court had to arrive at the value, not of the Water Board's undertaking, but of the parochial part of it in the City of London; and this had not been done by the Board. It was quite true that in certain cases it worked no injustice if, with a water undertaking, the rateable value of the whole was taken, and then divided between the parishes. Take, for instance, a small provincial water company extending over two parishes. If there was practically no difference between these parishes—the same class of population, the same class of houses, the same amount of water consumed, and the same expense of supply—it was perfectly fair to arrive at a rateable value for the whole, and then divide according to receipts. But in order to make this principle right, there would have to be assumptions—first, that the cost of supply was the same in the various parishes; and, secondly, that the profit per unit was approximately the same. If the expense of supply and the profit differed in the two parishes, it would be doing gross injustice to treat them as the same. If in one parish the profit was three times what it was in the other, would the tenant of the parochial part of the parish give the same rent for the other? The fallacy of the case put forward by the appellants was that it was founded on the assumption that throughout the whole of London the cost of supply was the same and the profit was the same. Suppose in one district the water was taken from an underground reservoir in the chalk of Kent, and only had to be pumped out, this would be cheap water; whereas if it came from the Thames and had to be stored in enormous reservoirs, it would be dear water. So far as the City of London was concerned, however, he was not going to urge with regard to the expense of supply that there was any difference. But though the expense of supply might be the same in the City as in the surrounding districts, the profit there was very much greater; and the appellants had assumed that it was not. If they ascertained what were the receipts for water in the City and what were the expenses, they would then find out what it would be worth a tenant's while to give for the parochial part. He could prove the profit per gallon in the City to be much greater than elsewhere. The charge for domestic water was on rateable value. Where therefore there were hereditaments highly rated, there was a large charge for water; and where they were lowly rated, there was a small charge. He would show that in the City the average for each hereditament was £394·83; while for the rest of London it was £50·22.

Mr. HORACE AVORY said he should object to all this when tendered in evidence, on the ground that, after the ruling of the Court that this hereditament was to be treated as a whole, such evidence would only go to show that it ought not to be treated as a whole.

Mr. BALFOUR BROWNE, however, replied that he was going to adhere to the ruling, and deal with the matter as a whole, though afterwards the principle must be a question for a special case.

The CHAIRMAN said he thought he understood Mr. Balfour Browne. As he took it, his contention was: You must not treat all these various parts in the same way on the gross receipts in each parish; but you must treat them according to the various circumstances that occur in each of the parishes.

Mr. BALFOUR BROWNE acquiesced, and, continuing his argument, remarked that the figures he had quoted showed the rateable value of a hereditament in the City to be eight times that of one in the rest of London. As to the intercommunication scheme, the Board had only exercised powers that were handed over to them by the old Companies. Therefore there was no change at all in the case, except the change of landlord. The tenant in the City would never regard that in the rent he would pay—he would pay the same rent whether the landlord was the Water Board or a Water Company. What the respondents had done was to ascertain the quantity of water supplied to the City; and having got this, they arrived at the amount per 1000 gallons received, which was 18·98d. Though he did not agree with it, he was going to adopt Mr. Ryde's figure of 8 per cent. on the gross receipts for the occupier's share; and the same with the statutables, in spite of the fact that they contained an item which he absolutely denied they had any right to. This was the depreciation or sinking fund, which was to replace the whole hereditament at the end of a certain number of years, and which was not a deduction. Even accepting these figures, he could make out the rateable value to £76,000, as compared with the £55,000 fixed. This, of course, depended on the figure of 18·95d. per 1000 gallons, which had been arrived at by taking a consumption of 5 gallons per head of the day population, and dividing the total amount received accordingly. If he proved this, he would ask the Court to come to the conclusion that, in distributing the rateable value, regard must be had to the profit in the City, by which the rent a tenant would give for this portion of the undertaking would be measured. In other words, in distributing whatever sum might be found as the rateable value of the whole undertaking, the net profits in each parish should be taken—subject, of course, to dead works.

Mr. HORACE AVORY objected that the result of this might be, if the same principle was followed out in all the other cases, that the rateable value of the different parts of the undertaking would exceed in the result the rateable value of the whole.

The CHAIRMAN: It cannot be. I will tell you once and for all the Court will not go into figures. They will fix these points: First of all, the rateable value of the whole undertaking; and, secondly, how it is to be distributed. Upon these two points you will go to the High Court, and possibly to the House of Lords; and after that you take their directions as to figures. If we are right, we shall leave the valuers to fight among themselves; and there will be a pile of money for you to spend.

Mr. HORACE AVORY: If so, all this evidence that is going to be given is mere waste of time.

The CHAIRMAN: I thought so from the first. We shall only give you the principle; and you will work it out for yourselves.

Mr. HORACE AVORY thereupon again objected to any evidence being given for the purpose of showing that the rateable value in the City was to be determined according to the net profits derived there for the undertaking. The appellants said it should be according to the gross receipts. The moment the Court determined that the concern must be rated as a whole, this meant that they were not going into the question of the net profits in each portion. The cross-examinations would all be under protest.

Mr. *H. H. Fuller*, examined by Sir EDWARD BOYLE, said he had made a valuation, following the decision of the Court as to taking the property as a whole. He came to the conclusion that the cost of the supply in the City was a fair average of the whole; but the water charges were in a greater proportion per unit than elsewhere. He therefore set to work to ascertain if he could by statistics what amount of water was delivered into the City, and the cash received for it. The tables he submitted showed that the area of Water London was 537·4 square miles; the rateable value, £55,339,219, or £102,976 per square mile; the population in 1901, 6,243,008; and the rateable value per head, £8·87. The area of the Administrative County of London was 121·12 square miles; the rateable value, £43,486,437, or £359,036 per square mile; the population, 4,536,541; the rateable value per head, £9 58; the number of assessments, 772,713; and the rateable value per assessment, £56·28. The area of the City of London, including the Inner and Middle Temples, was 1·15 square miles; the rateable value, £5,360,197, or £4,661,041 per square mile; the night population 26,923, and the day population 374,730; the rateable value per head of the resident population, £119·1, and of both day and night population £14·3; the number of assessments, 13,576; and the rateable value per assessment, £394·83. The rateable value per assessment in the Administrative County of London excluding the City was £50·22. By "day population" he meant those employed in offices and buildings. Persons passing in the streets, if they used water had it through a meter, and so it was a trade supply, and did not come into the estimate of the domestic supply per head. The water-rents were more easily and cheaply collected in the City than in the average houses throughout Water London. It seemed to him that the cost of repairs to mains would not be greater in the City than in other parts where the paving was the same. The profit per 1000 gallons of water supplied in the City, he considered, was 18·98d., as against 8d. over the whole of the Board's area. From the Board's second report, he learnt that the quantity of water supplied was roughly 80,000 million gallons a year; and of this he calculated that 2000 million gallons were supplied in the City. The gross receipts in the City were £158,130, or 18·98d. per 1000 gallons. The 80,000 million gallons divided into the total gross receipts of £2,761,010, gave 8·2d. per 1000 gallons. Working expenses, occupier's share, and statutable deductions (taking Mr. Ryde's figures, which witness did not agree with) came to 3·45d., or £28,750, leaving the rateable value, *plus* rates, in the City 15·53d. per 1000 gallons, or £129,380. Deducting the unproductive portions, *plus* rates (3·16d. per 1000 gallons, or £26,333), left the rateable value, *plus* rates, of the productive mains in the City 12·37d., or £103,047, or, less rates at 7s. in the pound, 9·16d. per 1000 gallons, or £76,331. Deducting the rateable value of the parishes not in the appeal, gave him a rateable value of the productive mains in the 101 parishes of 8·93d., or £74,435, to which had to be added the rateable value of the unproductive mains (0·21d., or £1748), making the total rateable value 9·14d., per 1000 gallons, or £76,183.

Witness's cross-examination was deferred, to enable Counsel to go through the figures.

Mr. *Sydney Walker*, Secretary of the City of London Real Property Company, Limited, and of the Association of Owners of City Properties, the members of which owned properties totalling one-eighth of the whole rateable value of the City, examined by Mr. RYDE, said he gave evidence last year in opposition to the Board's Charges Bill; and for this purpose he prepared tables showing that the rateable value of the people he represented was £681,623. Several meters were fixed at offices for a sufficient time to give a fair estimate; and it was found the average consumption was 5 gallons per head per day, as compared with 25·85 gallons over the whole Metropolitan area. Since this table had been put before Parliament, the reading of the meters had been continued; and the variations were very slight. The average was 5·1 gallons a day over practically two years. Another table showed that over twelve houses having a gross rental of nearly £80,000, the meter records came out at a cost of 5s. 7½d. per 1000 gallons. This was the actual price paid at the present time, as compared with 8d. per 1000 gallons over the whole district. The cost per head over the whole supply was 5s. 10d. a year, for which were received 25 gallons a day; while in the City they paid 13s. 1d. per head, and received only 5 gallons a day. The City really paid 11·6 times the price for water that a domestic consumer outside did,

Friday, Nov. 1.

Mr. *H. H. Fuller*, re-called, and cross-examined by Mr. HORACE AVORY, said he thought it was quite fair to calculate the average consumption over the whole of the City by what happened in the case of the meters that had been fixed in some places to ascertain the quantity used. He thought the statutable deductions had every possible relation to the gallons supplied. Supposing in a parish there was one main only supplying the parish, he suggested that the statutable deductions in the parish would bear a proper proportion to the number of gallons supplied—the statutable deductions for the whole of the undertaking. If he was wrong in his calculation as to the 2000 million gallons supplied, of course, the rest of his figures would be wrong in proportion. If he took the same average supply per head for the City as the average over the whole area, his 2000 millions would become 3715 million gallons; but to do so would be manifestly absurd, though for the purposes of deductions he said it was right to take the average over all the area. The whole theory of his valuation was that the rateable value in the City was to be calculated upon the net profits supposed to be derived in the City.

Re-examined by Mr. BALFOUR BROWNE: The meter experiment was in connection with houses in which there were 933 people employed and using water. Although he had adopted Mr. Ryde's figures, he regarded the occupier's share of 8 per cent. of the receipts as very excessive; and he did not agree that the statutables should include a sinking fund.

Mr. *Michael Faraday*, in answer to Mr. RYDE, said he did not find the conditions prevailing inside the City the same as those in the rest of the Board's area; the profits inside were much greater. To test this he had taken Shoreditch, where there was a large daily influx, like that which occurred in the City. The area of rateable property in the City of London Union was 609 acres, and in Shoreditch 642 acres. The population was 26,923 in the City, and 118 635 in Shoreditch. In 1905, the rateable value of the City was £5,107,182, and of Shoreditch parish £784,938. For the period immediately preceding the quinquennial valuation, the gross receipts in the 101 parishes of the City were £144,515, and in Shoreditch £34,260. This gave an excess in the City of £110,255. On the assumption that the working expenses in both areas were equal—and he thought this was a fair assumption—a tenant would give at least 90 per cent. of the net profits. The whole of the additional receipts must be net profit, because the expenses could not be increased, with the exception of rates. This 90 per cent. of the additional profit would be £99,230; and adding to it the £9°00 which witness said was agreed as the rateable value in Shoreditch (but which Mr. Horace Avory said was the basis of another appeal), he arrived at a rateable value in the City of London Union of £109,030. He agreed generally with the effect of Mr. Fuller's tables.

Cross-examined by Mr. HORACE AVORY: He had formed a general view of the result of treating the undertaking as a whole, instead of as separate Companies, as used to be the case. Inevitably the total rateable value of the whole concern must be slightly increased, because the expenses had slightly decreased. He did not quarrel at all with the appellant's valuation of the whole concern. His evidence was based on the idea that each Union or parish was to be rated according to the net profits. After hearing the evidence given by the Engineers and Accountants of the Board, he certainly still held that it would be possible to arrive at the net profits in any particular parish. The Engineers had not applied themselves to the question. Mr. Fuller had applied himself; and he had obtained evidence, which was only an estimate, he admitted.

The CHAIRMAN: Pardon me, he has not. All he has taken is an estimate; but he has not got any absolute figures to work upon.

Witness: I agree he has no absolute figures; but his expenses must be above the average. He has taken the average of the whole concern as expenses; but it is obvious that in the City the expenses cannot be above the average, when he has taken into consideration the expenses of all the reservoirs over the whole concern and given the parishes in the City a share of these expenses. He knew that in Shoreditch there were very large carrying mains, which were unproductive; and that these added considerably to the rateable value.

Mr. HORACE AVORY: Are you aware that in Westminster there has been a large reduction in the rating on this very basis of the concern being treated as a whole?

Witness: I think so, too. I think that you ought to get a reduction in other parishes where your expenses are so great that you absorb the rateable value. But it is not so in the City of London. I quite appreciate the point that if you increase here you ought to get a reduction there. But we are not dealing with these; we are only dealing with our own parishes.

Mr. *Joseph Francis*, examined by Mr. BALFOUR BROWNE, said he was formerly Water-Works Engineer to the New River Company, and when in that position he made some investigations as to the amount of water supplied within the City. The greater part of the City was served from one reservoir; and he ascertained the consumption by noting the water going in and that flowing out. To some extent, however, he had to estimate. He found that the quantity supplied to the City was nearly 5 million gallons a day on an average throughout the year. His calculation was made in 1892 for one of the Royal Commissions; but, so far as he knew, there had been no material change in the conditions since then.

Cross-examined by Mr. DANCKWERTS, witness admitted that the object of the Royal Commission he was referring to, for whom he prepared the information, was to find out whether the New River Company were capable of supplying their area. The East London Company supplied a very small area indeed in the City.

Mr. *Samuel Wood* said the receipts in the small portion supplied by the East London Company were £624; whereas the total gross receipts in the City were £158,130.

Mr. BALFOUR BROWNE announced that this was the case on behalf of the City of London. He had not in any way quarrelled with the decision of the Court that the undertaking must be looked upon as a whole; but he differed from his learned friends as to the principle upon which, when they had arrived at the value as a whole, they were to relegate this value to particular parts or particular parishes. Mr. Horace Avory had contended that the respondents were entirely wrong in looking at net receipts, and that the allocation must be carried out in regard to the gross receipts in the parish or Union. He (Mr. Balfour Browne), however, ventured to suggest that allocation by gross receipts was wrong in principle. It seemed to him absolutely absurd to suppose that the tenant, in fixing the rent that he would give for any portion of a hereditament, would merely look at the amount coming in; he must also have regard to the amount going out. They had got in this particular case the gross receipts in the City; and they had now proved, he thought very satisfactorily, both by Mr. Francis and by the calculation of Mr. Fuller, that the consumption of water in the City amounted to about 5 million gallons a day. If so, and they divided this figure by the agreed gross receipts, they arrived at what the Board were getting per 1000 gallons. Had there been any difference between them on the subject of working expenses, the problem would have been more difficult to solve; but the respondents had adopted Mr. Ryde's figures for these, and for the occupier's share, though they thought the latter far too high. With regard to the statutables, he differed from Mr. Ryde again. The inclusion of the sinking fund was an entire error; but he accepted it, and there was no suggestion that it was more expensive to supply in the City than in any place outside. Further, he might have seriously quarrelled with the way in which the appellants had tried to prove the unproductive parts of the undertaking. There was nothing which enabled one to test whether Mr. Ryde's valuation of the land was accurate or not. He had put down large sums of money without giving the acreage; and he refused to produce the deeds showing what it had cost. He denied that the cost was the right criterion, though he himself had taken it as the criterion in the case of the Staines reservoirs. If a criterion there, why was it not in other places? But, again, in order that the respondents might be absolutely safe, Mr. Fuller had accepted the unproductive works at Mr. Ryde's own figure; so that all the way down there was no quarrel between them, except upon the main matter of whether it was to be gross receipts or net receipts. He asked the Court to decide that net receipts must be looked at for this purpose. It was the conclusion of a very great Judge, Lord Denman; and he was perfectly certain that upon principle, altogether apart from authority, the Court would be of opinion that before any tenant working the undertaking would offer any rent at all, he would like to know, not what was the amount of the gross receipts, but what was the amount of the net receipts of this particular area.

Mr. DANCKWERTS said that many months ago, when they were preparing for this appeal, it was obvious to any person who took consideration of what he was about and what was coming, that there must be certain points which had better be settled by agreement; and the one point upon which an agreement was most likely to be possible was the directly productive works. But the other side would not hear of it. Now, however, they had accepted for practical purposes the valuation made by Mr. Ryde and the three engineers; and, therefore, very little was left for the Court to burden themselves with. Really, it came to be a question of how the rateable value of the directly productive part of the undertaking was to be distributed. He had always understood that in connection with gas and water undertakings these principles had been settled. In the first place, they were always, except in very accidental and rare cases, statutory concerns; and the statute erected them into a whole, and compelled them to be dealt with as a whole. Thus what the tenant had to take, and the landlord had to let, was a whole concern. The Courts had frequently said that one could not have a tenant for one part and another for a different part. Another principle which the Court had laid down was that in rating these undertakings one must, as far as possible, so arrange that the individual ratings shall, when carefully totalled up, exactly amount to the rateable value of the whole undertaking. The next thing that had been laid down was that the indirectly productive works must be valued in the parishes where they were situated. The result of this was that when they had the rent of the whole as one undertaking, they deducted rents which were necessarily allocated to a particular parish—namely, the individually productive works—and then they got a residue which was known as the rateable value of the directly productive works, which was a sort of floating sum that covered the whole of the parishes, and was not, on the supposition on which a rating was made in these matters, allocable by situation to any particular parish. It had been the universal practice to divide the rateable value of the directly productive works among the parishes, in proportion to the gross receipts in each individual parish. All the Court need decide was the rateable value of the directly productive works of the whole concern. For each parish in the City the receipts were known; and the parties had to divide what the Court fixed as the net rateable value into the gross receipts for each parish. So much for the profit basis; and this, he urged, would make the appeal successful. He admitted they could not ask the Court to fix in this case any lower figure than was stated in the notice; but if they were satisfied that upon the true valuation of the concern the figures would work out at something lower than those asked for in the notice of appeal, then the Court need not trouble themselves to fix the exact amount. All they need do would be to say they were satisfied that the appellants had proved enough to entitle them at all events to the figure contained in the notice. As a matter of fact, the whole dispute could be summed up in these words: The appellants represented substantially the ratepayers and consumers of Water London; while the other side represented a small section of those ratepayers and consumers. Then there was the capital basis; but the result of this particular appeal would not depend upon that, as they were entitled to succeed on the profit basis. But they wanted, if they could, with an eye to the future, to get the opinion of the Court upon this other question—and the opinion of the Higher Court, too. It would be an immense boon to the ratepayers of the Metropolis if they could get this principle adopted, because it was so simple, so easily worked, and so clear. First, the appellants said the Water Board were the only possible tenants of this concern; then that there would come a time when they would decline to be the tenants of this concern, and would rather provide one of their own to fulfil their statutory duty. This time would come when they found they could make a concern equally efficient at a cost which, when the percentage thereon was taken, would be less than the rent they were asked to pay.

Mr. Ryde and the other Surveyors said this cost would be £18,000,000; and the Board would say: "We can borrow this at 3½ per cent.; and that is practically all we need pay in order to put ourselves in a state to perform our duties." They could add something to this perhaps—make it, say, £25,000,000—and the 3½ per cent. upon this would be the rent which the Board might be willing to pay, to escape the trouble of making fresh water-works. The £42,000,000 paid by the Board was no criterion of the structural value of the works.

THE DECISION.

After some discussion,

The CHAIRMAN said: Now, the three points I propose to deliver an opinion upon are these. This is subject, of course, to anything we may hear from the arguments of Counsel and the evidence in the other cases. We think that the undertaking should be treated as a whole. We think that the calculations should be based on the accounts, and not on capital value; and we think that the distribution should be taken on the recognized principles laid down by the Courts, on the ratio of gross receipts in each Union or parish, so as not to amount to less than £31,277 in the City of London Union. A case will be granted to either party, if desired, upon any of these points.

Mr. DANCKWERTS: What the Court finds is that the rateable value is such that it will not exceed the figure we claim?

The CHAIRMAN: Yes.

Mr. BALFOUR BROWNE: Then I can say at once that I shall desire a case upon two points. First, as to whether it is right that the concern should be taken as a whole; and, secondly, as to whether, if it is taken as a whole, the distribution should be in the ratio of gross receipts or net receipts.

Mr. DANCKWERTS: In arriving at the calculation, the rateable value of the unproductive mains will be taken at £1748. It will be £32,277, less £1748—£30,529.

The CHAIRMAN intimated that these figures referred to the 101 parishes appealing, not the 114 contained in the City. He pointed out that the Court had not said anything about the figures for the rateable value of the whole undertaking. This they would keep an open mind about until they had heard the appeals of the other Unions. In the present case both parties had taken one figure of £1,202,086 as the rateable value of the whole concern; but the other Unions might argue differently, and this might alter the division on the gross earnings principle in the City.

WESTMINSTER COUNTY COURT—Tuesday, Nov. 26.

(*Before His Honour Judge* WOODFALL)

Metropolitan Water Board v. Cotton Seed Company, Limited.—The Question of Jurisdiction.

This is the case in which the Metropolitan Water Board are seeking to recover from the Cotton Seed Company, Limited, of Cubitt Town Wharf, E., the sum of £49 12s. 6d. for water supplied in extinguishing a fire on the defendant Company's premises. The Board contended that, as the water had been drawn by the firemen through the defendants' meter, and not direct from the Board's fire-main, defendants were liable to pay for it. The merits, however, have not been gone into, because, when the case was called on for hearing on Nov. 13, Mr. George Kebbell, the defendants' Solicitor, took objection to the jurisdiction—an objection which the learned Judge upheld, dismissing the action with costs (*ante*, p. 577). The point raised by Mr. Kebbell was that, by their demand notes, the Board had required payment of rates at a place outside the jurisdiction of the Westminster County Court; and therefore the Board must sue the defendants in the Court in the jurisdiction of which they carried on their business.

Mr. JELF now applied on behalf of the Board for leave to give notice of an application for a new trial.

His HONOUR at once stated it was his intention to grant it.

Mr. KEBBELL: I do not know if it is suggested you have misdirected yourself in law.

His HONOUR: Yes, in law. My attention was not drawn to the section which requires the consumer to pay his rates at the Board's head office.

Mr. KEBBELL: I know of no such section.

His HONOUR: It has been brought to my notice.

Mr. KEBBELL: I should like to see the section.

His HONOUR, however, said: I shall re-enter the case for trial. It has never been tried.

Mr. KEBBELL: That is not what the application asks. The Board are simply asking for leave to give notice of application for a new trial.

His HONOUR: I desire to save trouble and time.

Mr. KEBBELL: I am not going to help them.

His HONOUR eventually granted the leave asked, reserving all questions of costs; and, on Mr. Kebbell's application, he directed that the Board should serve their notice of application in three days.

Alleged Defective Gas Supply at Yardley.—The Yardley Rural District Council have had submitted to them a report by the Surveyor (Mr. A. W. Smith) respecting the unsatisfactory gas lighting of the district. In it, he referred to the low illuminating power of the gas supplied by the Birmingham Corporation, and to the tendency of the lights to "jump," which was dangerous, particularly as concerned private houses. He stated that the promises given, on behalf of Birmingham, to a deputation who waited upon them last year had not been fulfilled; and the gas supplied had diminished in quality. Mr. Fathers remarked that the district got a good supply for two or three days, and then the gas went off in quality. Other members residing in various parts of the parish also complained of the poor quality. It was decided that the Council be instructed to communicate with the Corporation of Birmingham calling attention to the defective gas supply to the parish of Yardley.

MISCELLANEOUS NEWS.

THE FATAL EXPLOSION IN GRACECHURCH STREET.

A Verdict of Suicide.

At the Union Relief Station, Borough Road, after two adjournments, Dr. F. J. Waldo, the Coroner for the City of London and the Borough of Southwark, last Thursday concluded his inquiry into the death of Mr. Onni Levantin, an importer, who died after an explosion at his office, No. 31, Gracechurch Street, E.C., under circumstances which have already been reported in the "JOURNAL" (*ante*, pp. 369, 509). Three other persons (including deceased's sister-in-law), were injured; and all of them were removed to Guy's Hospital, where Mr. Levantin subsequently died. Mr. Levantin had been missing from home; and his sister-in-law, the landlord, and a carpenter, proceeded to force the door of his office, to aid in which a lighted candle was requisitioned. Deceased was sitting in his chair; and the opening of the door was followed by a severe explosion. Afterwards the gas-bracket was found hanging by one screw; and Mr. Frederick J. Hood, Assistant Chief Inspector of the Gaslight and Coke Company, gave it as his opinion that the bracket had not been blown down by the explosion. When giving evidence three weeks ago, Dr. F. Womack, an expert in toxicology, of St. Bartholomew's Hospital, stated that the results of his examination had been of a negative character.

At the opening of the proceedings last Thursday, it was stated that the landlord, Mr. Henman, was still too ill to be present; while the deceased's sister-in-law, Mrs. Roloff, was not expected to leave the hospital for another three weeks. Mrs. Monica Levantin, the widow of the deceased man, said her husband was healthy, and never used any drugs; but he had lately suffered from neuralgia. He did not make any statement to her when she saw him in the hospital. So far as she knew his life was not insured; and he had never threatened to kill himself. He had, however, been a little worried by a new business—a wood-wool factory—which he had started in Finland. She was not aware that he had anything to do with explosives; but he had a patent reversible turbine, which was not his own invention, but on which he had done a considerable amount of work.

The next witness was Frank Mercer, the carpenter who was summoned on the morning of the explosion to pick the lock of the office door. He said the door was in a very dark recess; and as he could not work without a light, Mr. Henman (who accompanied him, together with Mrs. Roloff) lit a piece of candle, and held it while witness tried to pick the lock. This he failed to do, as it was a Yale; so he started to cut the wood away round it. He looked through the letter-box, and smelt a very peculiar smell, like naphtha spirit; but this was not unusual, as he had noticed a similar odour in the office before. Deceased dealt in skins; and whenever they were exposed, there was the same strange smell. There was no odour of gas; of that he was certain. He got the door open, and found Mr. Levantin sitting in his chair breathing heavily. Witness went up to him; and no sooner had he touched him than there was a white flash with a blue light in it. The explosion took place directly afterwards; and though it was loud, it was not so loud as gas explosions he had heard. The room was a mass of flame; and finding that the explosion had blown the door shut, witness smashed a panel in order to escape from the room. Deceased's brother-in-law had told him that Mr. Levantin used sometimes to experiment with chemicals. The explosion did not take place directly the candle was lighted, as he was working about three minutes at the door.

Sergeant Horton, the Coroner's Officer, said he visited the office, and found a patent for turbines in the name of another person, and also one taken out by deceased. There were numerous applications for overdue accounts; and Mr. Levantin's pass-book, taken in conjunction with the counterfoils of his cheque-book, showed his banking account to be considerably overdrawn. There was, however, nothing pointing to an intention on the part of deceased to take his life. Witness said he had seen Mrs. Roloff at the hospital; and she told him that when looking through the office letter-box before the explosion, she did not smell anything unusual. He had also interviewed Mr. Henman, who said he did not know that deceased was in any monetary difficulties. Speaking of the explosion, he stated that he held the lighted candle for the carpenter, who entered the room. Mr. Henman was about to follow, when suddenly there was a yellow flame, and a loud report. He did not smell anything unusual.

The Coroner said that Dr. Womack had made some more investigations; and he had sent on a written report of the evidence he would have given had he been able to attend that day. In this, he said he had further examined the materials received. The urine was slightly alkaline—nearly clear. It contained neither albumen nor sugar. These bodies, though occasionally found in cases of carbon monoxide poisoning, were not at all characteristic. Some dried vomit, together with that on a handkerchief, had been submitted to a very careful analysis, but did not contain any trace of inorganic or organic poison (no alkaloid). He had examined the small quantity of blood-stained fluid in the jar of viscera, and was now satisfied as to the presence of carbon monoxide in the blood. The proportion of the colouring matter of the blood [hæmoglobin] which was converted into carboxy-hæmoglobin [the compound of hæmoglobin with carbon monoxide] was approximately 18 per cent. This was a proportion that would probably eventually prove fatal. The failure of the spectroscopic test, he said, must be attributed to the percentage of carboxyhæmoglobin being too small for detection by this method. He had, however, succeeded in detecting it by two chemical tests. These were both entirely satisfactory; and by comparison of the colour with that of a solution of carboxyhæmoglobin of known strength, he estimated that the blood contained 18 per cent. of carboxyhæmoglobin, and therefore 82 per cent.

of oxyhæmoglobin. He would therefore like to modify his former opinion, and state that, while agreeing that the cause of death was primarily heart failure from shock due to burns, a contributory cause was carbon monoxide poisoning. He thought the people at Guy's Hospital succeeded in keeping the man alive for some hours with oxygen inhalation, during which time the proportion of carboxyhæmoglobin was lessening, and that, but for this treatment, he would probably have died sooner from carbon monoxide poisoning. The Coroner pointed out that this was in agreement with Dr. Kenelm Digby, who said that the fact of the man having lived 8½ hours from the time he was taken out of the room, first by artificial respiration, followed by five hours' inhalation of pure oxygen, got rid of the carbon monoxide.

Continuing, the Coroner remarked that at the previous hearing he had had before him Mr. F. J. Hood, the Assistant Chief Inspector of the Gaslight and Coke Company; and one of the questions he put to him was as to the nature of the gas supplied to No. 31, Gracechurch Street. Mr. Hood gave some valuable evidence; but he said that he was not an Engineer, and so could not answer this. Subsequently, he (the Coroner) communicated with Mr. T. Goulden, the Chief Engineer of the Company, who said the City was supplied from the Bow Common Station, which did not manufacture carburetted water gas. The gas supplied from Bow Common was supplemented to the extent of about 25 per cent. which was distributed from the Company's Beckton works, which contained about 20 per cent. of carburetted water gas. The toxic agent in the gas made at Bow Common was carbon monoxide to the extent of 6 per cent., which, with the addition of the gas from Beckton would be probably increased to from 9 to 10 per cent.

Proceeding, the Coroner said he had also written to the Chief Gas Examiner, Professor Vivian B. Lewes, who replied that the Gaslight and Coke Company were sending out a mixture of approximately 75 per cent. coal gas and 25 per cent. carburetted water gas; and the proportion of carbon monoxide in the mixture about Oct. 23 [the date of the accident] would be about 10 per cent. As an explosion took place, if it were due to a mixture of gas and air, there must have been between 4 per cent. and 29 per cent. of coal gas in the air, or ½ per cent. to 2¾ per cent. of carbon monoxide, which would cause death if inhaled for a sufficient period.

In summing up, the Coroner said the facts which pointed to suicide were the gas-bracket being broken off, which the experts agreed could not have been done by the force of the explosion. Then Colonel Fox stated that one of the taps of the stove (the top one), used for a boiling-ring, was on. The door was locked; but this was often done on the Continent, and besides it was a self-locking door. In addition, there was the financial position which had been revealed. As to the points which made it possible for it to be a case of accidental death, Mr. Hood had said that the bracket might have been wrenched off unintentionally, by deceased slipping when trying to light it; but this would not account for the tap of the stove being turned on. The crevices of the door or window were not stopped up in any way.

The Jury, after retiring, returned a verdict that deceased committed suicide owing to financial reasons; the cause of the explosion being illuminating gas. In answer to the Coroner, the Foreman said they did not desire to add any rider to their verdict.

CORPORATE MANAGEMENT OF INDUSTRIES.

Responsibility of Directors and Employees.

The Institute of Directors held their fourth annual dinner last Wednesday, under the presidency of the Duke of Argyll; and the toast of the evening was proposed by the Solicitor-General (Sir William Robson, K.C., M.P.). In doing so he referred to the Companies Act of last session, and said he did not deny that it had increased, in form, at all events, the responsibility of directors; but he did not think it had done so in substance. He believed that on balance it would be found that the Act had done more to relieve directors than to impose on them any onerous or unfair obligation. Was there any ground for apprehension in the closer definition which had been given to directorial duties by the Act? He thought there was none. There was ground for supposing that this closer definition would tend to strengthen and increase public confidence in matters relating both to the formation and working of companies in general; and this was as great a gain to companies as it was to the public. Speaking of the benefits of corporate management, he said it immensely extended the scope of industry and increased the profit of commerce; it also helped in the distribution of industrial profit among a greater number of persons. Every shopkeeper, clerk, or artisan who could save a £10 note was, by the modern principle of corporate management, now able to share in the profits of the great industries of the country, which before the Joint-Stock Companies Act would have been altogether beyond his reach. This made for social stability. He did not think the working classes realized the close connection there was between what the City called confidence and what they called employment. The two were indissolubly connected. Whatever shook confidence diminished employment. That was a consideration which, he thought, should be borne in mind by some of the new school of politicians who had recently come more or less to the front, and were suggesting to the industrial classes what they called the "nationalization" of the means of production. They might go round and get all the factories and mines and workshops, with the help of a few policemen, and with a few soldiers thrown in; but of what use were all these—the mere shells of industry—without the public confidence which brought forth the circulating capital that they could not nationalize? It did not seem to have occurred to some of those people who talked about "nationalizing" all the means of production that they could only nationalize the physical means, and that these were a very small proportion of the means of production requisite to provide employment. They could not nationalize money. If they could not nationalize money, still less could they nationalize confidence; and without confidence the whole scheme and system of modern industry would collapse.

RECOGNITION OF BRAVERY AT MANCHESTER.

It was stated in the "JOURNAL" a few weeks ago that bronze medals had been awarded by the Royal Humane Society to J. H. Bell and W. Surrey, for the brave efforts they made to save a companion named Prior, who was overcome while examining a syphon last July at the Bradford Road Gas-Works of the Manchester Corporation. The medals were presented at Bradford Road last Wednesday, in the presence of the Lord Mayor (Alderman Holt), the Lady Mayoress, and the members of the Gas Committee.

In the course of a few remarks, Alderman Gibson, the Chairman of the Committee, said that if it was right to bestow honours on men who had done noble deeds on the field of battle, as doubtless it was, it was not less seemly that they should honour those who did brave acts in the course of their daily work. These men, knowing the risk they ran, deliberately placed their lives in jeopardy to save a fellow-worker from death. The Gas Committee recognized this fine conduct, and then brought it under the notice of the Royal Humane Society, who had sent down their medals and certificates. The Lord Mayor pointed out that these medals and certificates were never presented without adequate inquiry and just reason. They were therefore such as any man might prize and hand down as heirlooms to his family. He added that Surrey and Bell were "gentlemen" in the true sense of the word, because they hesitated not to do a noble deed. It was acts such as theirs that had given the British race its reputation for courage; and he was glad to think that, whenever the necessity arose, this quality would not be found wanting.

The certificates and medals were then presented; and the Lady Mayoress pinned the medals on the men's coats, to the accompaniment of hearty hurrahs. Bell said: "I thank you very much for the honour of receiving this medal; but I only did my duty." Surrey remarked: "It gives me much pleasure to be able to come here. What I did was only my duty; and if such a thing should occur again, I would not shrink from it. I would do my duty to the utmost of my power." The Lady Mayoress said she was proud to have the privilege of taking part in this ceremony. It was an honour to honour brave men; and these men had been conspicuously brave.

GAS PIPES AND FITTINGS IN DUNDEE.

In virtue of the powers conferred upon them by the Dundee Corporation Order Confirmation Act of last session, the Gas Commissioners have issued the following specification for pipes and fittings laid either in the first instance or on the occasion of any renewal; and they have also given notice that no supply of gas will be granted to any premises until all the requirements of the specification have been fulfilled to the satisfaction of the Gas Engineer (Mr. A. Yuill). For tenements of one storey, the inlet service-pipe from the main is to be not less than ⅝ inch internal diameter; for those of two storeys, the inlet and upright pipe is to be not less than ¾ inch internal diameter for the first floor, and ⅝ inch for the second floor; in those of three storeys, the inlet and upright pipe is to be not less than 1 inch internal diameter for the first floor, ¾ inch for the second floor, and ⅝ inch for the third floor; and in those for more than three storeys, the upright piping is to be not less than ½ inch above the third storey. All branches from any of the above-mentioned upright pipes to the meter to be not less than ½ inch internal diameter; and in no part of any premises will any piping of less than ⅜ inch be permitted. In premises of which the lower floors have been supplied with gas, and wherein subsequently a supply is also required for the upper floors, the upright pipes are to be replaced by new pipes of sizes in accordance with the terms of the specification. The preceding regulations apply to ordinary dwelling-houses; but in larger houses or premises used for special purposes the sizes of pipes will be regulated by the number of burners required, and in accordance with the following scale:—

Size of Meters.	Size of Meter Unions.	Number of Burners.	Size of Meters.	Size of Meter Unions.	Number of Burners.
2-light	½ inch	6	15-light	1 inch	45
3 ,,	⅝ ,,	9	20 ,,	1¼ ,,	60
5 ,,	¾ ,,	15	30 ,,	1⅜ ,,	90
10 ,,	1 ,,	30	50 ,,	1½ ,,	150

A brass valve or stopcock with screwed ends, and contained in a cast-iron box and cover, will be provided by the Gas Commissioners, and fixed to any new or renewed service-pipe before it enters the premises. This, however, does not apply to service-pipes of less than 1 inch internal diameter. In any case of complaint of defective supply of gas, the Commissioners will examine the piping and fittings, and if these do not conform to the terms of this specification, no action by the Commissioners will follow, nor will any further notice of the complaint be taken until such time as the pipes and fittings have been replaced by others of the specified sizes.

Federation Proposal Negatived at Burslem.—There was a poll last week of the ratepayers of Burslem on the proposed federation of Potteries towns; and the result was: Against scheme, 3248; for, 2040—majority against federation, 1208. Four years ago a poll on the same question resulted in an adverse majority of 2213. At present there are on the register 7163 voters.

Gas Poisoning Fatality at Hull.—A verdict of "Accidental death" was returned by a Coroner's Jury who inquired into the suffocation by coal gas of a retired cow-keeper named Perry, aged 75, who was found dead in bed at Hull. It was supposed that, having turned off the light, deceased had turned the tap round again, as it was full on when the room was entered. Having lost his sense of smell, he would not have noticed the escape. A son explained that his father's hand was shaky, and the gas-tap was very loose.

PORTSMOUTH WATER COMPANY.

The Half-Yearly General Meeting of this Company was held at the Offices last Thursday—Mr. W. GRANT, J.P., in the chair.

The SECRETARY (Mr. J. L. Wilkinson) having read the advertisement convening the meeting, the report of the Directors, together with the accounts for the six months ending the 30th of September, was presented. In their report the Directors stated that the available balance on the profit and loss account was £28,153, out of which they recommended the payment of the full statutory dividends. This, after deductions for void houses, &c., would leave a balance of about £9463 to be carried forward. During the half year, 2849 yards of additional service mains and 92 yards of trunk mains were laid; making a total of about 63½ miles of the latter and 156 miles of the former. The number of additional services connected with the mains during the half year was 610; making the total number of premises under constant supply by the Company in all the districts 47,932. The exceptionally wet and inclement summer naturally caused less water to be consumed, especially in the form of supplies by meter. The quantity of water pumped from Havant and Bedhampton during the half year was 1,449,080,623 gallons, or an average daily supply for all purposes of 7,918,473 gallons; being a decrease of 209,675 gallons daily compared with the corresponding period of last year. Exclusive of all supplies by meter, the quantity sent out for domestic use was equal to an average of about 24·39 gallons per diem per head of the population, compared with 24·94 gallons in the corresponding period of last year. The Directors added that they proposed accepting the tender of Messrs. John Mowlem and Co., Limited, for the construction of filtration works, at the price of £73,092, which would, they said, incidentally provide a large increase in the storage capacity of the Company's high-level service reservoirs.

The CHAIRMAN, in moving the adoption of the report, referred to the loss the Company had sustained by the death of Alderman Thomas King, who, he said, possessed singularly diversified knowledge of many branches of business, and was always most eager to devote his time and energies to the service of the Company. With regard to the water-rentals, there had only been the infinitesimal reduction of £300 on a total revenue of about £37,000. They were therefore able to declare the full statutory dividends as usual. These had been fully earned, and the shareholders were in the enviable position of carrying forward the balance of £9400. Proceeding to deal with the question of the filtration scheme, he said the tenders were unexpectedly large; but the Directors recognized that the work was such that it was exceedingly difficult to arrive at any reliable estimate, and also that efficiency of filtration was the main object. It was useless to ask whether or not filtration was necessary; it was forced upon them. The discoloration of the water was palpable and undeniable, and could only be dealt with by filtration. The Medical Officer of Health and the Town Council took the matter up, and he was far from suggesting that they did otherwise than their duty in so doing. The Press also discussed the subject; and they were only fulfilling their functions as watchers over the public good. It had never been shown that there was anything positively deleterious to health in the discoloration of the water which took place; but it had to be dealt with. The greatest experts—Professor Percy Frankland and Mr. Hawksley—were called in, and the scheme was prepared; everything being made subservient to the filtration being thoroughly effective. At the same time they would increase their storage capacity. This was a question which had been mentioned for several years, but hitherto the Directors had not considered it necessary to spend the shareholders' money for the purpose. As to the cost of the new scheme, they would have to provide roughly £3000 a year; but, having regard to the readiness with which they made up the loss of £5000 a year that they voluntarily surrendered in 1900 for rating purposes, he anticipated that the present burden was one which could be easily borne. Moreover, they would carry forward about £9400, and they had a balance of £17,000 on the contingency fund. Personally, he was not sorry filtration had come, as it smoothed their way with the Corporation, the War Department, and the Admiralty, and restored that confidence in the perfect purity of Portsmouth water to which it was really and justly entitled on account of its excellent quality.

Colonel C. LANYON OWEN seconded the motion.

Mr. J. READ remarked that if it had been known that the filtration of the water would have cost £70,000, the opposition to the proposal would have been stronger than it was.

Mr. J. SMYTH expressed the opinion that, with the new liability upon them, the shareholders might whistle for back-dividends. He asked what had become of the proceeds of recent sales of stock.

Mr. C. W. BALL said the new filtration scheme meant that a whole year's revenue was gone, and they would not be a penny better off. He thought the shareholders should have been able to see the plans, and have had information as to the calling in of the experts. It had been stated in a paper that the Directors had already accepted the tender for the work.

The CHAIRMAN, in reply to the closing remarks of the last speaker, said if the Directors could not perform a purely administerial matter of business like that, they would not be fit for their positions. He could not think that Mr. Ball had heard the report of the Directors at the March meeting, in which full information as to the scheme was given. As to the proceeds of the sale of shares, £14,000 had gone to clear off an overdraft at the bank, and they had a balance in prospect for the filtration works.

The motion was carried unanimously, and the proceedings ended.

LOUGHBOROUGH WATER SUPPLY.

Blackbrook Reservoir Filled.

A heavy snowfall which occurred on the night of Sunday week, the 24th ult., was a matter of rejoicing at Loughborough, and the cause of a hasty visit of the Chairman of the Water Committee (Mr. James Cartwright) and a party the next day to the new dam at Blackbrook, to witness the first cascade through the six arches forming the overflow weir into the still water pond 65 feet below. Hearty congratulations were offered as the party traversed the access tunnel which passes longitudinally through the heart of the dam at the brook level, and found that its concrete walls had bleached out quite dry, and that there was no sign of leakage. Careful observations made throughout the twelve months which the reservoir has taken to fill have shown that no water passes under or round the ends of the dam. This is constructed of

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 692.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
500,000	10	Oct. 11	10½	Alliance & Dublin 10 p.c.	19—20	..	5 5 0
268,324	10	,,	7½	Do. 7 p.c.	13—14	..	5 7 2
200,000	5	Oct. 30	7	Bombay, Ltd.	6¾—6¾	..	5 3 8
40,000	5	,,	7	Do. New, £4 paid	4½—5	..	5 12 0
50,000	10	Aug. 29	14	Bourne- mouth Gas and Water } 10 p.c.	27½—28½	..	4 18 3
51,810	10	,,	7	B 7 p.c.	16½—17	..	4 2 4
53,200	10	,,	6	Pref. 6 p.c.	14½—15½	..	3 17 5
380,000	Stk.	Aug. 15	12½	Brentford Consolidated	243—248	..	5 0 10
300,000	,,	,,	9½	Do. New	182—187	..	5 1 7
50,000	,,	,,	5	Do. 5 p.c. Pref.	115—120	..	4 3 4
206,250	,,	June 13	4	Do. 4 p.c. Deb.	103—103	..	3 17 8
220,000	Stk.	Sept. 27	11½	Brighton & Hove Orig.	205—215	..	5 4 8
246,320	,,	,,	8½	Do. A. Ord. Stk.	153—158	..	5 4 5
460,000	20	,,	10	British	38—40	—1	5 0 0
104,000	Stk.	Aug. 15	6	Bromley, Ord. 5 p.c.	116—119	..	5 0 10
165,700	,,	,,	4½	Do. do. 3½ p.c.	87—90	..	5 0 0
500,000	10	Oct. 11	7	Buenos Ayres (New) Ltd.	10¾—11¼	..	6 4 5
250,000	Stk.	June 27	4	Do. 4 p.c. Deb.	91—93	—1	4 6 0
150,000	20	July 12	8½	Cagliari, Ltd.	26½—27½	..	6 0 0
100,000	10	—	—	Cape Town & Dis., Ltd.	6—8	..	—
100,000	10	Apl. 26	4½	Do. 4½ p.c Pref.	7—9	..	5 0 0
50,000	50	Nov. 2	6	Do. 6 p.c. 1st Mort.	48—50	..	6 0 0
103,000	Stk.	June 27	4½	Do. 4½ p.c. Deb. Stk.	94—96	..	4 13 9
157,150	Stk.	Aug. 15	5	Chester 5 p.c. Ord.	108—110	..	4 10 11
1,443,280	Stk.	,, 29	5⅛	Commercial 4 p.c Stk.	100—105	..	4 19 0
560,000	,,	,,	5	Do. 3½ p.c. do.	98—103	..	4 17 1
475,000	,,	June 13	3	Do. 3 p.c. Deb. Stk.	81—83	..	3 12 3
800,000	Stk.	,,	6½	Continental Union, Ltd.	110—115	..	5 13 1
270,000	,,	,,	7	Do. 7 p.c. Pref.	138—143	..	4 17 11
460,170	Stk.	—	5½	Derby Con. Stk.	—	..	—
45,000	,,	—	4	Do. Deb. Stk.	—	..	—
486,090	10	July 31	12	European, Ltd.	22½—23½	..	5 2 2
354,060	10	,,	12	Do. £7 10s. paid	16¾—17¼	—½	5 2 10
15,182,590	Stk.	Aug. 15	4⅛	Gas- light and Coke } 4 p.c. Ord.	92—94	..	4 13 6
2,600,000	,,	,,	3½	3½ p.c. max.	86—88	..	3 19 7
3,799,735	,,	,,	4	4 p.c. Con. Pref.	101—104	..	3 16 11
4,193,975	,,	June 13	3	3 p.c. Con. Deb.	81—83	..	3 12 3
258,740	Stk.	Sept. 13	5	Hastings & St. L. 3½ p.c.	93—95	..	5 2 0
82,500	,,	,,	6½	Do. do. 5 p.c.	114—117	..	5 11 1
70,000	10	Oct. 11	11	Hongkong & China, Ltd.	19—20	..	5 10 0
4,940,000	Stk.	Nov. 14	8	Imperial Continental	167—170	—½	4 14 2
473,600	Stk.	Aug. 15	3½	Do. 3½ p.c. Deb. Red.	91—93	..	3 15 3
195,242	Stk.	Aug. 29	6	Lea Bridge Ord. 5 p.c.	110—120	..	5 0 0
306,083	,,	June 27	4	L'rpool Unit'd Deb. Stk.	108—110	..	3 12 9
561,000	Stk.	Aug. 29	10	Liverpool United A	220—222	—1	4 10 1
718,100	,,	,,	7	Do. B	157—159	—2½	4 8 1
152,736	Stk.	Feb. 14	7⅞	Maidstone 5 p.c.	140—145	—2	5 5 2
75,000	5	Nov. 28	5	Malta & Medn., Ltd.	4—4½*	+¼	5 11 1
560,000	100	Oct. 1	5	Met. of } 5 p.c. Deb.	99—101	..	4 19 0
250,000	100	,,	4½	Melbourne } 4½ p.c. Deb.	100—102	..	4 8 3
541,920	20	Nov. 14	3½	Monte Video, Ltd.	10½—11½	..	6 1 9
1,775,892	Stk.	Aug. 15	4⅝	Newc'tle & G'tesh'd Con.	106½—107½	..	4 6 1
406,025	Stk.	June 27	3½	Do. 3½ p.c. Deb.	89—90	..	3 17 9
15,000	10	Aug. 29	10	North Middlesex 10 p.c.	19½—20½	..	4 17 7
55,940	10	,,	7	Do. 7 p.c.	13—14	..	5 0 0
300,000	Stk.	Nov. 28	8	Oriental, Ltd.	135—138*	..	5 15 10
60,000	5	Sept. 13	7	Ottoman, Ltd.	6—6⅛	..	5 7 8
398,490	5	Oct. 31	7	Primitiva Ord.	6½—7	..	5 0 0
796,980	5	July 31	5	Do. 5 p.c. Pref.	4⅝—5½	..	4 17 7
488,900	100	June 1	4	Do. 4 p.c. Deb.	94—96	..	4 3 4
1,003,000	10	Oct. 11	8	River Plate Ord.	12⅞—13⅛	..	6 0 9
312,650	Stk.	June 27	4	Do. 4 p.c. Deb.	92—94	—1	4 5 1
250,000	10	Sept. 27	8	San Paulo, Ltd.	13—13½	..	5 18 6
125,000	50	July 1	5	Do. 5 p.c. Deb.	48—50	..	5 0 0
135,000	Stk.	Sept. 13	10	Sheffield A	243—245	..	4 1 8
209,984	,,	,,	10	Do. B	243—245	..	4 1 8
523,500	,,	,,	10	Do. C	243—245	..	4 1 8
70,000	10	Nov. 14	10	South African	14½—15½	..	6 9 0
6,429,895	Stk.	Aug. 15	5½	South Met., 4 p.c. Ord.	119—121	..	4 10 11
1,895,445	,,	July 12	3	Do. 3 p.c. Deb.	81—83	..	3 12 3
201,720	Stk	Sept. 13	8	South Shields Con. Stk.	155—157	..	5 1 11
605,000	Stk.	Aug. 15	5½	S'th Suburb'n Ord. 5 p.c.	114—117	..	4 14 0
60,000	,,	,,	5	Do. 5 p.c. Pref.	117—120	..	4 3 4
117,058	,,	July 12	5	Do. 5 p.c. Deb. Stk.	120—125	..	4 0 0
502,310	Stk.	Nov. 14	5	Southampton Ord.	104—109	..	4 11 9
120,000	Stk.	Aug. 15	6¾	Tottenham and } A 5 p.c.	120—123	..	5 9 9
398,940	,,	,,	5¼	B 3½ p.c.	100—103	..	5 1 11
149,470	,,	June 27	4	Edmonton } 4 p.c. Deb.	99—101	..	3 19 3
182,380	10	June 13	8	Tuscan, Ltd.	10½—11	+¼	7 5 0
149,900	10	July 1	5	Do. 5 p.c. Deb, Red.	100—102	..	4 13 0
193,742	Stk.	Aug. 29	5	Tynemouth 5 p.c. max.	107—109	..	4 11 9
30,000	Stk.	Feb. 14	8	Wands- worth and } A 5 p.c.	—	..	—
255,636	,,	Aug. 15	6½	B 3½ p.c.	128—133	..	4 17 9
75,000	,,	,,	5¾	C 3½ p.c.	—	..	—
80,075	,,	June 27	3	Putney } 3 p.c. Deb. Stk	75—80	..	3 15 0
845,872	,,	Aug. 15	5⅛	West Ham 5 p.c. Ord.	100—103	..	4 19 6
185,000	,,	,,	5	Do. 5 p.c. Pref.	118—120	..	4 3 4
228,300	,,	June 27	4	Do. 4 p.c. Deb. Stk.	101—104	..	3 15 11

Prices marked * are "Ex div."

concrete, with displacers—all the materials being quarried on the site. The down-stream face is of random rubble work, and the up-stream face of blue brick. The rock, both in the foundations and in the quarries, is of the pre-Cambrian age, and has been named by Professor W. W. Watts, in the memoirs of the Geological Survey, as the Blackbrook series of the Charnian system, as it cannot at present be correlated with any other formation in Great Britain. The Blackbrook beds form the oldest series in the district, and consist largely of very fine-grained flinty grits, which have been used as concrete aggregate, and also of a more massive band of coarse grit, which has been used for the facing work; and their extreme age and their many "ups and downs" in life are amply recorded in their shattered and contorted conditions when quarried. The undertaking is a fortunate one in many respects, as the Loughborough Corporation have found a customer for some of their surplus water in the Leicester Corporation, who are using it as a supplementary supply until the Derwent works are completed; and they have also arranged for a supply to Long Eaton. It is likewise one of the rare cases in which the whole of the water is available for use; the Corporation, acting on the advice of their Consulting Engineers (Messrs. George and F. W. Hodson, MM.Inst.C.E., of Loughborough), having purchased the whole water rights of the stream, and the compensation water is limited to an agricultural supply of 30,000 gallons per day. This fact, in conjunction with the low cost of the dam—only slightly over £100,000—makes the supply probably one of the cheapest in England. Another point of interest is that the reservoir was filled to the height of 40 feet in the spring of 1906, when the dam was only about 2 feet above that level, in order to avoid a water famine; and the large quantity abstracted during the ensuing summer showed how serious the deficiency would have been if this precaution had not been taken.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The Corporation Gas-Works in Paisley have long been known to be in the very first line in the matter of administration. They may now be said to be in the first line in the matter of equipment. The business which was transacted at Paisley on the afternoon of Wednesday last was quite notable. The quantity of new plant which has been introduced into the works is simply amazing. In Paisley they have still in operation, working continuously, the oil-gas installation which was put in there under the second patent of the late Mr. William Young, of Peebles, but which, in the hands of Mr. G. R. Hislop, the Engineer at Paisley, has been so altered and improved that it may be said truly of it that it is no longer according to Mr. Young's patent, but a process of Mr. Hislop's own. I may say that, although it is still worked, the installation is not, in the present state of things, looked upon as adding to the efficiency of the works. The efficiency is to be found in Mr. Hislop's general arrangements. The works are, if not old-fashioned, certainly not new-fashioned, in their general aspect; and the visitors on Wednesday received a lesson upon the possibilities which exist in the adaptation of old conditions to modern ideas, which will serve to set them thinking. Mr. Hislop has introduced the De Brouwer charging-machine; being the second in Scotland to do so—the other order having been from Alloa. Discharging machines have not been put in, for want of space. The noticeable feature is that while the charging machine and the gravity bucket system of coal conveying have been introduced, they have been put into a retort-house constructed upon the lines which were worked upon in by-gone years. Most engineers would have set about, without any regard to the capital account, making the retort-house an up-to-date one in the matter of floor and roof space; Mr. Hislop has spared his Corporation the expense of this work, and has sandwiched the new plant into the old setting—and has done it in such a way that, as has been already shown, the new arrangement can be worked to profit. For an example of how to provide "new lamps for old," the student of mechanics in gas engineering will find in the Paisley Corporation Gas-Works an object-lesson which is not surpassed in any part of the United Kingdom. Provost Eadie, in speaking of Mr. Hislop, made use of the Scriptural expression that "his eye was not dimmed, nor his natural force abated." The remark was unmistakably true. A detailed account of what was seen by the visitors will be found p. 709.

The Edinburgh and Leith Gas Commissioners held their first meeting after the municipal elections on Monday. The business at it was formal; being chiefly that of appointments. Bailie Maxton proposed that Bailie Bryson, of Leith, be re-elected Convener of the Works Committee. The motion was agreed to unanimously, and Bailie Bryson returned thanks for the honour which had been done him. Dr. Cullen proposed that Judge Mallinson be appointed Convener of the Finance and Law Committee, in succession to Mr. R. Menzies; and the motion was agreed to. The Commission have only these two Committees; and the whole of the members were appointed members of both Committees. The only other business was the continuation of remits to the Committees. A standing remit to the Works Committee was "to attend to the erection of the new gas-works at Granton, and to advise as to the disposal of the old gas-works and other properties of the Commissioners." Bailie Bryson said that during the past year there had been no expenditure on new works at Granton; and he thought that this portion of the remit might be discharged, and that the Committee should only be asked to look after the selling of the old works. This was agreed to. The second remit to the Works Committee was "to consider whether, having regard to the large and increasing use of gas for cooking, heating, and, with the incandescent mantle, for lighting, the time has now come for obtaining powers for reducing the candle power of the gas." Bailie Bryson thought that this remit should be dispensed with, as they were thinking of promoting a Provisional Order authorizing them to reduce the illuminating power. They required to go to Parliament next year to obtain an extension of time for the powers they had with reference to the reclamation of the fore-

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shore at Granton; and the two subjects could be taken together. The Commissioners, however, agreed to retain the remit; their view being that the Works Committee should consider the whole subject, and lay it before the Commissioners in due course. The other standing remits were agreed to; and this concluded the business of the meeting.

It is announced that at a meeting of the shareholders of the Hawick Gaslight Company, held yesterday—Mr. R. Noble, of Borthwickbrae, presiding—it was agreed to confirm the action of the Directors in remodelling the constitution of the Company, and adding £15,750 to the value of their share capital; making it now £31,500. The Chairman stated that the Directors had also considered the advisability of converting the Company into a limited liability concern.

In the Elgin Town Council on Monday the Gas Committee brought up the question of the new gasholder. The Committee recommended that the Gas Manager be instructed to obtain offers for a two-lift gasholder with steel tank, 84 ft. by 20 ft. 9 in., to be submitted to the Committee before the next monthly meeting. Bailie Gordon, the Convener of the Committee, moved approval of the recommendation, and Mr. Wittet seconded. The Council adopted the recommendation of the Committee. The Gas Committee recommended, on a petition by workmen in the gas-works, that stokers be granted an increase of ½d. per hour, and the other permanent employees an increase of 1s. per week. The recommendation of the Committee was adopted.

Important extensions have recently been made at the works of the Brechin Gas Company, Limited, of which Mr. Allan Reid is Manager. The gas consumption has been on the increase for some time; and this year it was found necessary to increase the storage capacity. This has been effected by taking out one of the old single-lift gasholders, which had served its day, deepening the stone-built tank by a top ring of concrete, and preparing it for the reception of a telescopic gasholder, 60 feet in diameter, with two 20-feet lifts, which was purchased and removed from the New Street works of the Edinburgh and Leith Gas Commissioners. The removal and re-erection of the gasholder was undertaken by Messrs. C. & W. Walker, Limited, of Donnington, who originally erected the holder in Edinburgh; and the deepening of the tank was done by a local firm of builders—Messrs. Gordon and Ross. The work was duly completed, and the holder has been serving the town for several months. Four new luteless purifiers, 16 ft. by 11 ft., have been erected on a stage, and are worked by a Weck centre-valve. The purifiers are so arranged that they can be charged from above, and the foul material dropped direct into carts. A new steam-engine and exhauster, and a steam-boiler, were added; and a complicated system of piping and connections was replaced by a simpler arrangement, rendering the whole plant more effective. A new sulphate of ammonia plant has also been erected, so that now the gas-works are quite up-to-date, and amply justify Mr. Reid's foresight and care. All the extensions were designed and supervised by Messrs. A. Gillespie and Son, of Glasgow. The purifiers and staging, the engine and exhausters, and the sulphate plant were supplied by Messrs. Henry Balfour and Company, Limited, of Leven, Fife.

CURRENT SALES OF GAS PRODUCTS.

Sulphate of Ammonia. LIVERPOOL, *Nov.* 30.

The market remains in a lifeless condition, and prices are again easier. Buyers abroad are holding off, and direct orders are extremely scarce; while requirements for covering November contracts had practically all been arranged for a week ago. Scotland alone remains fairly firm, supplies there not being too great to cover demand so far. The closing quotations are £11 17s. 6d. per ton f.o.b. Hull, £11 8s. 9d. to £12 per ton f.o.b. Liverpool, and £12 3s. 9d. per ton f.o.b. Leith. The forward position is still neglected. Makers so far do not seem inclined to drop their prices substantially. There has, however, been a good deal of speculative offering abroad at prices not much above the spot level; but it is understood that not much business has resulted.

Nitrate of Soda.

This article is firm in all positions, and spot prices are 11s. per cwt. for 95 per cent., and 11s. 1½d. for refined quality.

Tar Products. LONDON, *Dec.* 2.

The markets are still quiet all round, and there is little business doing. Pitch is easy in tone, and low figures have been accepted for prompt delivery. London makers are in most cases well sold. It is reported that some of them have been compelled to decline orders owing to inability to deliver; but there is plenty of pitch obtainable for delivery to June in other quarters, and low figures have been accepted. Orders from both the Continent and South Wales for near delivery are very scarce. Creosote is quiet in tone for immediate delivery; but for contracts over a fair period, say nine or twelve months, there is a firm tone. Benzols are quiet. Ninety per cent. is steady, but there is not very much demand. Fifty-ninety per cent. is neglected, as is toluol, of both of which consumers still appear to hold good stocks. Solvent naphtha is quiet for both prompt and forward delivery, and is being offered in the North at 10d. Carbolic acid is steady. It is fetching prices which are well beyond the offers put forward by Continental consumers, and much in advance of the parity of crystals, which are very quiet and difficult of sale.

The average values during the week were: Tar, 13s. 6d. to 17s. 6d., *ex* works. Pitch, London, 23s. to 23s. 6d.; east coast, 22s. to 22s. 6d.; west coast, 21s. to 22s. Benzol, 90 per cent., 8¼d. to 8¾d., casks included; 50-90 per cent., 8d. to 8⅛d., casks included. Toluol, 9⅛d. to 10d., casks included. Crude naphtha, 3⅛d. to 4d., naked; solvent naphtha, 10d. to 1s., casks included; heavy naphtha, 11d. to 1s. 1½d., casks included. Creosote, London, 2½d. to 2¾d., naked; North, 2½d. to 2⅝d., naked. Heavy oils, 3d. to 3¼d., naked. Carbolic acid, 60 per cent., 1s. 7½d. to 1s. 8d., casks included. Naphthalene, £6 10s. to £12 10s., packages included; salts, 37s. 6d. to 45s., do. Anthracene, "A" quality, 1½d. to 1⅝d., casks included.

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PARTICULARS UPON APPLICATION.

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Sulphate of Ammonia.

The market is quiet, and has not had quite such a firm tone during the past week, which is perhaps accounted for by second-hand stuff offering. The principal London Gas Companies are still very well sold and firm in their ideas; but smaller London makes have been sold at under £12 on Beckton terms. In Hull, business has been done at £12 to £12 1s. 3d.; in Liverpool, at £12 1s. 3d. to £12 2s. 6d.; while in Leith, makers quote £12 5s. and £12 7s. 6d. to £12 10s. for forward. Stocks everywhere are known to be small, and prices therefore should keep steady.

COAL TRADE REPORTS.

Lancashire Coal Trade.

There has been an influx of orders during the week for house coal, which, added to the strong and continuous demand for engine boiler fuel, maintains the high prices of coal of all kinds in the county. Stocks are everywhere practically exhausted, and coal, as fast as it comes to the surface, is moved away for consumption. The same conditions apply to gas coal and cannel. Prices at the pits are: Best house coal 15s. to 15s. 6d. per ton, secondary 14s. to 15s., common 12s. to 13s. 6d., burgy 10s. 6d. to 11s. 4d., best slack 9s. 6d. to 10s. 4d., medium 8s. 6d. to 9s., lower qualities 7s. 9d. to 8s. 4d., coal for shipping 13s. to 14s. 6d. f.o.t. at the tips. Furnace coke is 19s. to 25s. The decision of Lord James of Hereford on the question of whether the operative miners in the Lancashire and Cheshire Federation shall have another 5 per cent. increase in wages has been adjourned to Monday next at the Westminster Palace Hotel, where the Coal Conciliation Board will meet. In the meantime, the members of the Federation have been following up their present advantages by holding meetings and agitating for a new standard of wages by the raising of the minimum 30 per cent. above the standards of 1879 and 1886 respectively.

Northern Coal Trade.

There is a good demand for coal generally. The supply seems full, however, and the lessened consumption of fuel at the iron and other works is now throwing more on to the market, especially of second-class coal. In steam coal, best Northumbrians are quoted from about 15s. 3d. to 15s. 6d. per ton f.o.b., second-class steams are 14s. to 14s. 6d., and steam smalls are quiet at from 9s. 3d. to 9s. 9d. The collieries are working well, and only the effects of the detention of steamers by fog or allied cause interfere with the heavy shipment. In the gas coal trade, there is now a heavy delivery on the long contracts; but there are some collieries which feel the loss of quantities they were wont to supply to the southern gas companies. Prices of Durham gas coals vary from about 12s. 6d. to 14s. 9d. per ton f.o.b., with special qualities quoted in some cases at 6d. per ton higher than the last price. As to contracts, there is little to say—offers for next year being in negotiation; but the margin of price between buyers and sellers seems more than usual. One sale of second-class gas coals has been made at about 12s. per ton f.o.b.; and that may in some degree indicate the trend of prices. Coke is weak; and gas coke feels the effect of this. Good gas coke is quoted at from 19s. to 19s. 6d. per ton f.o.b.; but the output is now very heavy.

Scotch Coal Trade.

Trade remains unchanged. Shipping shows larger, because the weather conditions, before the advent of the storms at the end of last week, were more favourable than for some time previously. Prices, particularly for ell, show a tendency to become easier. The output of splint is taken up readily. The prices quoted are: Ell, 13s. 6d. to 14s. 6d. per ton f.o.b. Glasgow, splint 15s. to 15s. 6d., and steam 13s. 6d. to 13s. 9d. The shipments for the week amounted to 318,701 tons—an increase of 37,987 tons upon the previous week, and of 45,802 tons upon the corresponding week of last year. For the year to date, the total shipments have been 13,338,655 tons—an increase of 783,865 tons upon the corresponding period of 1906.

Sales of Stocks and Shares.

At the Mart, Tokenhouse Yard, E.C., last Tuesday, Mr. Alfred Richards offered for sale, by order of the Directors, 1000 new ordinary £10 shares of the Southend Water Works Company. They ranked for a maximum dividend of 5 per cent.; and, in view of the dividends paid on the Company's existing capital, they were entitled to receive this dividend. The new issue was quickly placed at from £10 5s. to £10 15s. per share. At the Lion Hotel, Skegness, the previous day, Mr. G. G. Dunkley sold, by order of the Directors, 600 new ordinary £5 shares in the Skegness Gas Company. They ranked for a maximum dividend of 5 per cent.; and this amount was paid on similar shares for the year 1906. They fetched from £5 15s. to £6 10s. per share. Last Wednesday, Mr. Frank Amos offered for sale by auction, in lots of £10 each, sufficient new "A" stock of the Canterbury Gas and Water Company to realize, with premiums, the net amount of £3565. The whole of the lots were quickly disposed of at prices ranging from £19 5s. to £19 10s. apiece; the average being £19 7s. 6d. Subsequently Mr. Amos offered £263 consolidated "B" stock in the same Company in 26 lots; and it readily found purchasers at £19 15s., and in one case at £20, per £10 of stock. At a recent sale by Messrs. Brackett and Sons, some 4½ per cent. debenture stock of the Tunbridge Wells Gas Company fetched £115 and £116 per £100 of stock.

Cost of the Lighting at Olympia.—Many of our readers are doubtless aware that a motor show has lately been held at Olympia. Some curiosity having been manifested in regard to the cost of the lighting, the Directors have given the official figures, which show that it was just over £500 per day. When all the lights were in use, the consumers were paying more than £1 per minute.

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NOTE ADDRESSES.

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Increased Railway Rates for the Carriage of Coal.—The policy of raising rates for the carriage of coal is being enforced, beginning with yesterday, by the Great Northern, Great Central, and Midland Railway Companies. From some fifty collieries in Nottinghamshire and Derbyshire, the rates to Syston and Leicester have been increased from 1d. to 3d. per ton.

Retford and the Lincoln Water Bill.—At a meeting of the Retford Town Council last Friday, the Water Committee were authorized to oppose the Lincoln Water Bill. Alderman Holmes, the Chairman of the Committee, remarked that the proposal of the Lincoln City Council to make borings at Eckesley, about 4½ miles from the Retford source of supply, was a very serious matter. The Town Clerk said that they would need to have a clause inserted to the effect that should their water supply at any time be damaged, the Lincoln City Council would be willing to compensate them and supply them with water. Alderman Beverley pointed out that the district was being "tapped" all round for water. Worksop had purchased some land at Shireoaks, and were shortly going to bore for water; and Nottingham were taking water about 9 miles away from them. He could not understand one county going into another for their water supply.

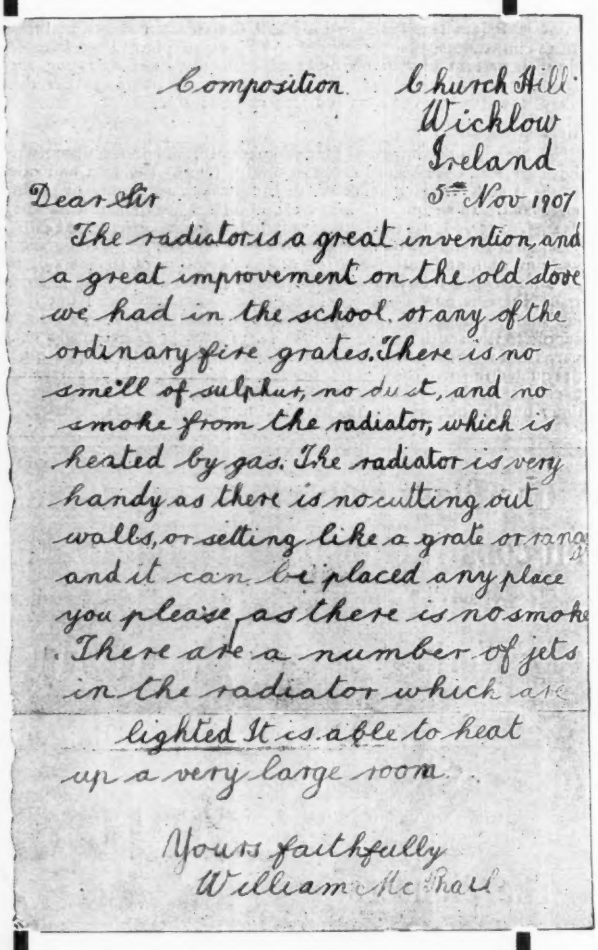
Gas Supply in the Brentford Company's District.—With reference to the paragraph on this subject which appeared in the "JOURNAL" last week (p. 662), in which it was stated that the Surveyor to the Twickenham District Council had reported the result of tests of the Brentford Company's gas on the 5th and 19th of October as 10·14 and 10·66 standard candles respectively, it should be explained that the tests in question were made with the old Letheby burner, and that the one used by the Local Authorities is carried from district to district. We understand that the testing-stations are quite unsuitable for photometry, and that in one case the tests are made in an underground cellar; while the fact that the gas passes through an excessively long service-pipe also tells against the Company. Their standard is 14 candles; and the illuminating power, as tested by the "Brentford" burner, on the nights in question, was 16·35 and 15·01 candles respectively, or 2·35 and 1·01 candles above the standard, compared with 10·01 and 10·66 candles shown by the Letheby burner.

Manchester Water-Rates.—The Manchester Water Committee will present to the forthcoming meeting of the City Council a report pointing out that since the water-charges were revised in January, 1906, the large increase in consumption has compelled the Committee to hasten the laying of the third pipe-line from Thirlmere, and the construction of the Heaton Park reservoir. This involves very heavy payments out of revenue for interest and sinking fund during construction, and before any return for the outlay can be obtained. The payments in respect of the third pipe-line alone will during the next five years amount to a sum of £82,000. The present water-rates are: Public 2d., and domestic 8d. in the pound; and it is recommended that these be restored to the level of 1898—viz., public 3d., and domestic 9d.—whereby the revenue would be increased to the extent of £21,000 per annum. The Committee say that the Thirlmere works, in respect of which a capital expenditure of upwards of £3,000,000 has been incurred, have not only been carried out without any increase in the water-rates beyond those in force at the time the Act authorizing the construction of such works was passed in 1879, but, on the other hand, considerable reductions in the water rates and charges in the city have been made during the last nine years.

Public Lighting of St. Austell.—An indication of the feeling provoked by the rivalry between the Gas Company and the Electric Lighting Company at St. Austell was presented at a meeting of the Urban District Council last Tuesday. A letter was received from Mr. Arthur Coode, one of the principal residents, complaining of the quality of the light supplied by the Electric Lighting Company, who at present have the contract for public lighting. In many places, said Mr. Coode, the lamps were not giving 40-candle power, though the contract was for 60 candles; and in numerous instances they gave no light at all. The Surveyor supplemented the complaint by presenting a list of lamps not lighted in a recent period. Mr. Nicholls, one of the members, said that in the cases enumerated by the Surveyor the Electric Lighting Company had rectified matters on receiving a notification from him, and he (Mr. Nicholls) considered the complaint most trivial. No list of lamps not alight was kept when the town was lighted by gas. The Surveyor said he was instructed by the Lighting Committee to make the list in consequence of the number of complaints. It was decided that the Electric Lighting Company should be communicated with on the subject.

Cost of Electric Lighting at Barnstaple.—A discussion on the financial position of the town took place at a meeting of the Barnstaple Town Council yesterday week. The Mayor (Alderman A. J. Reavell) presented the half-yearly estimates, which included a sum of £400 on account of the deficit upon the electric lighting, leaving a balance of £430 to be provided for in subsequent estimates. Mr. Smale complained that the estimate of the cost of public lighting was placed at too low a figure. In the summer half of the year, they expended £1255; and for the winter half the estimate was only £1300. Unless a good many of the lights were switched off during several hours of the night, they would exceed the estimate by some hundreds of pounds. Mr. Smale also pointed out that at the beginning of the financial year they had a credit balance of £2061; but, according to the estimate, this would be shrunk to £578 by March 31 next. They all knew where the difference had gone. They had paid £1000 towards the loss on the electric light undertaking, and provision was made in the current account for £400 more; and there was also £100 for depreciation on the working account. These items made a total of £1500, which was equal to a rate of 7½d. in the pound. The cost of the public lighting meant another 1½d. What the electric light was costing the ratepayers could now see. Mr. Barrett, the Chairman of the Electric Lighting Committee, said there was no reason why the estimate for public lighting should be exceeded. For the corresponding half year the expenditure under this head was £1362. Mr. Perrin contended that it was wrong to argue that the cost of the electric light was equal to a 9d. rate; and the ratepayers would not be so foolish as to believe it. If they had levied a rate of 1d. in the pound for each half year since the undertaking was started, it would have met the whole sum.

A CLEVER SCHOOL-BOY'S OPINION of the "ST ANDREW."


Composition
Church Hill
Wicklow
Ireland
5th Nov 1907

Dear Sir

The radiator is a great invention, and a great improvement on the old stove we had in the school, or any of the ordinary fire grates. There is no smell of sulphur, no dust, and no smoke from the radiator, which is heated by gas. The radiator is very handy as there is no cutting out walls, or setting like a grate or range and it can be placed any place you please, as there is no smoke. There are a number of jets in the radiator which are lighted. It is able to heat up a very large room.

Yours faithfully
William McPhail

WRIGHTS THE RADIATOR PEOPLE.

Extension of Incandescent Gas Lighting at Leyton.—The Leyton Urban District Council decided at their last meeting to request the West Ham Gas Company to convert the remaining flat-flame street-lamps in the district to the incandescent system.

Gas Failure at Ticehurst.—Last Saturday week, there was a failure of the gas supply in the evening at Ticehurst; but fortunately it was of very brief duration. The following day, however, the supply was considered insufficient to afford the necessary illumination of the Parish Church and Wesleyan Chapel; and the evening services were cancelled.

Gas v. Electricity in Hackney.—The Works and General Purposes Committee of the Hackney Borough Council recently considered a suggestion to substitute electricity for gas in High Street, Homerton. Owing, however, to the excessive annual cost (£72 under one scheme and £144 under another, as against £26 now paid for gas) they have decided against the proposal.

Additional Capital for the Norwich Water Company.—Readers will see, from an announcement which appears elsewhere, that the City of Norwich Water-Works Company are inviting tenders for 500 ordinary £10 shares; being part of the capital authorized by their Act of 1904. They are entitled to a maximum dividend of 6 per cent. (the rate paid on the ordinary capital for the past fourteen years), and they will be issued fully paid at a minimum price of £16 5s.

Gas Explosion at Seaham Harbour.—While a plumber and a lad in the employ of the Seaham Gas and Lighting Company were engaged some days ago in clearing, with the aid of a pump, the pipes in the house of a Mrs. Watson, a smell of gas was noticed in one of the rooms. To ascertain the source of this, a board was removed; and this was followed by a loud explosion. Considerable injury was received by the lad; and Mrs. Watson also suffered from shock. The furniture and the house were greatly damaged.

Merthyr and the Pontypridd Water Company.—The Directors of the Pontypridd Water-Works Company have informed the Merthyr Corporation Water Committee that they have considered the draft agreement submitted by the Corporation for a supply of water, and regret that the terms and conditions the Council have thought necessary to impose would not enable them to proceed with the negotiations at the present time. The Chairman remarked this was one of the strongest arguments for proceeding with the Bill the Corporation were promoting. The conditions they had inserted in the agreement were directed to enable Merthyr to fulfil their prior obligations in the event of an exceptional drought.

Gas Fatality in Lambeth.—An inquest was held last Tuesday by the Coroner for Lambeth on the body of James Smith, a bootmaker, 78 years of age, who was found by his son dead in the kitchen with the door locked. Deceased was lying on the gas-stove, as if he had fallen over it. Gas was issuing from the ring; and a box of matches was lying on the floor. Apparently the man was worried over the illness of another son; but he had never threatened to do himself any harm. A constable said he was told that deceased had his leather apron over his head when found. The police surgeon stated that death was due to asphyxia from coal gas poisoning. It was possible the man might have fainted, and fallen over the stove. The Jury returned a verdict of "Accidental death."

Barry Council and the Gas-Works.—At a meeting of the Barry Gas and Water Committee on Monday of last week, the Gas Engineer (Mr. F. M. Harris), reporting upon the retorts at the gas-works, said he considered the delay in the filling in of the spare arches most serious. With the exception of one bed of horizontals, the existing ones were practically burnt out. The furnaces of four beds of inclined retorts were so burnt away that, if not speedily seen to, they might burn through into the secondary air chambers, which would completely ruin the regenerators; and they would have to be renewed at great expense. The responsibility of the delay, he added, was with the Committee and the Council; and he stated this fact that it might be entered in the minutes. The Committee considered the report a very serious one; and agreed to meet at the works on the following morning to inspect the retorts.

Proposed Gas-Works Extensions at Belfast.—Recently the Belfast Gas Committee waited on the Parks Committee to ask for a portion of Ormeau Park for the extension of the gas-works. The Chairman (Mr. J. A. Doran) said it must be evident to the members of the Corporation, as well as to the Committee, that the site of the existing gas-works was already so overcrowded that there was not room to carry on the work in an economical manner, much less to meet the rapidly-increasing demand for gas for any length of time. He pointed out that in 1880 the output was 548 million cubic feet per annum, and this year it was 1969 million cubic feet. In his opinion, and that of the Committee, there was no spot in the neighbourhood of Belfast so suitable for the construction of gas-works as the low-lying ground in Ormeau Park. It was near the existing works; and the nature of the ground was such as to ensure good foundations.

Belfast Gas Committee and the Manchester Exhibition.—The report of the members of the Belfast Gas Committee who visited the recent Manchester Gas Exhibition contains the following: "The deputation were met by Mr. J. G. Newbigging, M.Inst.C.E., the Gas Engineer to the Manchester Corporation, who very kindly gave them the benefit of his complete knowledge of the exhibition, thereby saving them a considerable amount of time and trouble. They made an exhaustive inspection of the exhibits in which they were more particularly interested, and remarked with pleasure the ability and energy of those in charge, who spared neither pains nor trouble to explain to visitors the articles on their stalls, and the advantages to be derived from the use of same. The deputation confirm the recommendation for the establishment of a show-room in the centre of the city, where specimens of all that is most up-to-date in gas appliances should be exhibited, not necessarily for sale, but to illustrate the comfort, convenience, and economy which are derivable from the adoption of such appliances in the households of the people, and, while doing so, to benefit the gas undertaking by bringing about a greater demand for gas."

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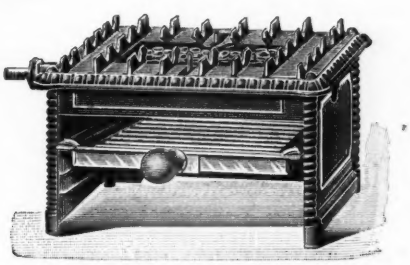

Telegrams: "AMOUR, LONDON."

Telephone Nos.: 1890 HOLBORN; CENTRAL 194.

A. G. CLOAKE,

54, HOLBORN VIADUCT, LONDON, E.C.

The Hydraulic Engineering Company, Limited, have received instructions for the supply to the Gaslight and Coke Company of a large direct-acting hydraulic coke-hoist, to deal with trucks having a gross weight of 18 tons. The lift is to be installed at the Bow Common works of the Company, and is to work with a pressure of 700 lbs. per square inch.

In view of the existing trade depression at Workington, the Gas Committee have unanimously resolved to reduce the price of coke at the gas-works to 1d. per cwt. to genuine and necessitous unemployed; the distribution of the tickets to be left to a Committee composed of the officials of the various Trade Unions, under the supervision of the Mayor (Alderman Baines).

The shareholders in the Electric Supply Company at Burgess Hill have been informed by the Directors that their offer at par of 500 preference shares and 1000 ordinary shares in the Company proved abortive. To meet liabilities, it had become advisable to mortgage the undertaking and raise further capital; but a loan of £1200 at 4 per cent. had been partially arranged, together with £350 in shares.

We have received from Messrs. J. & W. B. Smith, of Farringdon Road, a booklet showing their latest specialities for gas lighting. It, of course, only contains a few examples of their lamps, pendants, &c., for inverted burners; but a larger collection will be found in the firm's new general catalogue.

Everybody connected with the gas industry is aware that the late Mr. Thomas Fletcher was a pioneer in the utilization of gas in the laboratory and the workshop, and that the Company of which he was the founder have made an important branch of their business the manufacture of appliances for saving labour in industrial operations. The great variety of these appliances is strikingly manifest in the Company's catalogue for 1908, which consists of upwards of 100 large quarto pages (8½ in. by 11 in.), excellently printed in two colours, showing how numerous are the ways in which the artisan's labours have been lightened, and, we venture to think, his work has been better done, as the result of the inventiveness of Mr. Fletcher and those who have succeeded him. Messrs. Fletcher, Russell, and Co.'s furnaces, &c., are now adapted for use with uncarburetted water gas or any of the producer gases, which can be used cold direct from the holder.

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No. 5.—"On Reliability, with Instances of Misplaced Confidence."
No. 6.—"On Shop Lighting, with Special Reference to the Flame Arc Lamp."

This series of Leaflets will be useful, not only for distribution among Householders generally, but for circulation among Shareholders to fortify them with arguments in defence of the commodity in which they have invested capital. Copies of each Leaflet should also be kept in every Gas Undertaking's Show-Rooms.
Prices for Quantities on Application to WALTER KING, 11, BOLT COURT, FLEET STREET, E.C.

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WORKS ASSISTANT. Swindon United Gas Company. Applications by Dec. 23.
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WORKING MANAGER (GAS-WORKS). Manwaring, Cannon Street, E.C.
DRAUGHTSMAN. No. 4877.
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Tar.
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